

A New and Easy GUIDE to
The USE of the GLOBES;
 AND THE
Rudiments of Geography.

WHEREIN

The Knowledge of the HEAVENS and EARTH is made easy to the meanest Capacity: First, by giving a short and concise Account of the four Quarters of the World, with the Distance and Situation of the most principal Islands and inland Places, and by the Solution of Seventy useful Problems, in *Geography, Astronomy, Navigation, &c.* Written in familiar Dialogues, in order to render it more easy, pleasant, and diverting to the Learner: With some Observations on Mr. Neale's Patent Globes.

To which is annex'd,

THREE useful TABLES.

- | | |
|---|---|
| <p>I. Shews the Latitude and Longitude of the principal Places from the Meridian of <i>London</i>.</p> <p>II. Shewing the Sun's Place, Declination, Time of Rising and Setting; Length of Days and Nights, and Beginning and End-</p> | <p>ing of Twilight every Week, according to the New Style.</p> <p>III. Shews the Latitude, Longitude, Right Ascension, and Declination of the most eminent fixed Stars.</p> |
|---|---|

By **DANIEL FENNING**, *K^{to}*

AUTHOR of the *YOUNG ALGEBRAIST'S COMPANION*, and the *BRITISH YOUTH'S INSTRUCTOR*, or, A New and Easy GUIDE to *Practical Arithmetic* and the *Universal Spelling-Book*.

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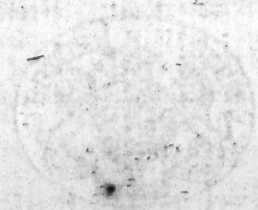
The **SECOND EDITION**,

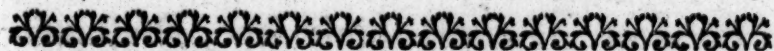
With Improvements by the Author.

L O N D O N,

Printed for S. CROWDER, at the Looking-Glass, facing St. Magnus Church, London-Bridge, 1760.

(Price bound Two Shillings and Six-pence.)





D E D I C A T I O N.

To all public Tutors and Lovers of Mathematical Learning, especially those that I have had the Honour to instruct.

THE Use of the Globes is now become very common among Gentlemen, to what it was some few Years ago; and there are Numbers that cannot bear the Thoughts of going thro' a tedious, tho' regular Process of *Geometry, Trigonometry, Algebra, &c.* that find a great Pleasure in learning upon the Globes, and this I imagine is because the Knowledge of them is so easily attained to. Nothing is easier than practical *Geography*, commonly called *the Use of the Globes*; because no other Branch of Learning is previous to it. He that can read well may arrive at the Knowledge of them

iv DEDICATION.

as soon as another that is well acquainted with Figures.

Some of you may think it a Presumption in me to publish a Book upon a Treatise after so many upon the same Subject, and especially as Dr. *Harris's* is so much used: But many of you are sensible I have been obliged to explain him to you; and you have owned he is not so clear in many of the Problems as could be wish'd. Besides, his is a general Treatise of the Rudiments of Astronomy, mixt with the Use of the Globes; but this little Tract treats of Nothing of that Sort, but goes through a Series of Problems (as you will see more particularly in the Preface) Step by Step; and as every Problem has an Answer, you cannot be at a Loss to know when you are right.

As I have try'd to render it both easy and useful in all public Academies, &c. as well as to private Gentlemen, you will no Doubt, excuse some few Errors; and in giving it a kind Reception you will do me great Honour, and very much oblige,

London, Aug.
24, 1754.

Your humble Servant,

D. FENNING.



P R E F A C E.

Kind Reader,



Here present you this small
Treatise of Geography and *The*
Use of the Globes.

The Geographical Part you
may very justly suppose I bor-
rowed from different Authors, who no
Doubt, were obliged in the same Man-
ner to borrow their Accounts from pre-
vious Publications: And this Thing is
always allowable in History, tho' not in
every Part of Learning.

Besides, many Hundreds may happen
on one Book, who may never see another
on that Subject; therefore a Number of
Books can never fail of being serviceable
to the Public; and if every Author makes
but an Improvement upon what he takes
in Hand, he does well, and the Reader is

in some Measure obliged to him. It may be ask'd what Improvements can be made here, since there are so many large Volumes upon the Subject? I answer, that as my Knowledge is not sufficient, so my Intention never could be to give a better Account of Things than they have done. But the Point in Hand is, whether I have not drawn the Work into a narrow Compass, so as not to burthen the Memory, and yet, at the same Time, to give a pleasant and satisfactory Account of what is both necessary and useful to every common Reader. If I have in any Respect done this, I have done as much in the Geographical Part as I intended, and more; for my Design at first was only to treat upon the Description and Use of the Globes; therefore I hope, if any Errors have crept in on the first Part, they will be pardoned. For

Some Authors, observe, differ from others. Thus *Gordon* says, that the Metropolis of *Maryland* is *Baltimore*, in Honour of Lord *Baltimore*; but *Taylor* and *Dapier* say *Annapolis-Royal* is the Capital.
—Which

P R E F A C E.

vii

—Which of these are right I cannot determine; only this I say, that *Gordon* seems to be right according to History, and *Taylor* according to Custom; because *Annapolis Royal* is the chief Place of Traffic and Business. But I leave this to better Judges, and will give some Account of the Work in general.

Dialogue I. II. III. and IV. Contains a short and easy Account of the Situation of the most principal Places in the known World, with their Distance from *London*, in an Arch of a great Circle.

Dial. V. and VI. Contains a general Description of the Globes, with the Nature and Property of the Sphere, and the different Situation of the Inhabitants of the World in respect of each other.

Dial. VII. An Explanation of the most useful Terms in *Geography*; to which is annexed, 3 useful Tables.

1. Shews the Latitude and Longitude of the most principal Places from the Meridian of *London*.

2. Shews the Sun's Place, Declination, Time of rising and setting, &c. &c.

3. Shews the Latitude and Longitude, ^{right} Ascension, &c. of the most eminent ^{fixed} Stars, taken from *Senex's Globes*.

Dial. VIII. Contains 70 Problems perform'd by the Globes, many of which are very useful in shewing the Nature of Spherical Triangles, and are applied to *Navigation, Dialling, &c.* and I have not only given you the Rule to work them by, but have given you the Answers to the *Problems*, that you may know when you are right. If indeed your Answer be not exact with mine in Respect to *Minutes*, never mind that; for I have taken the nearest Quarter of a Degree for the Answers in general: Thus, if it were 12 Minutes, I call it 15 or $\frac{1}{4}$ of a Degree. I have done the same when it is 20 *Minutes*, but if it be near $\frac{1}{2}$ a Degree on the Quadrant, I call it 30 Minutes; and this I have done on Purpose to avoid puzzling the
the

P R E F A C E.

ix

the Learner, because we cannot guess to a *Minute* or two on the *Quadrant*, and Globes will often differ, for Want of good Appendants.

As for the Distance of Places from *London*, I have taken it from no Book or Person; and tho' I agree with *Echard*, and several others, in Respect of Degrees, yet I differ from them in my Answer in Miles, most of them allowing but 60 Miles or Minutes to a Degree, and I have counted $69\frac{1}{2}$ to a Degree. If you cannot multiply the Degrees by $69\frac{1}{2}$, then multiply by 70, and take $\frac{1}{2}$ the Number of Degrees out of that Product, it is the same as multiplying by $69\frac{1}{2}$.

In fine, I have endeavoured to render it as useful as I could, and I am sensible *Any-body* may (of himself) learn the Use of the Globes by it, if he will but take the Trouble to learn the Signs and Terms previous to such an Undertaking.

Arts and Sciences are not learnt by supine Reading only; there must be some Practice, or else the bare reading will never make a compleat Artist; and if so,

how can it be expected that he should understand that never reads at all.

It is not saying, I have got *Chambers's* Dictionary of Arts and Sciences, or a Thousand Volumes in your Library, that will convince the World you understand them; for, without a little Pains, you will never be a Jot the wiser in the practical Part of the Mathematical Studies.

But as for the Use of the Globes, it is so easy and so natural that most Persons esteem it as a Pleasure, rather than a Study; and as the Knowledge of them is very useful, as well as entertaining, I would recommend it to young Gentlemen in general, as they may learn the Use of them without Pains, and, in short, without Loss of Time.

I am, Kind Reader,

Your humble Servant,

and Well-wisher,

London, Aug.

24, 1754.

D. FENNING.



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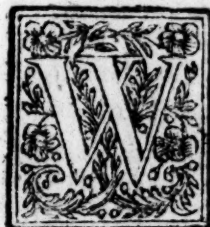
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Y.

Mr. John Younge.

T O T H E
P U B L I C K.



WE whose names are hereunto subscribed,
 having perused this epitome of geo-
 graphy, do allow it to be very well
 adapted to the capacity of all such as
 would have a true and speedy notion
 of the situation of the most principal
 places in the known world. And for a variety of
 problems so easily set forth, and so plainly demon-
 strated, we beg leave to recomend to every learner, as
 the most useful book extant. Witness our hands,

George Coles, *Surveyor.*

Henry Deacon, *Accomptant.*

Edward Griffiths, *Surveyor and Accomptant.*

Antony Gilbert, *Surveyor.*

Abraham De Lire, *Philo. Math.*

John Quant, *Teacher of the Mathematics.*

William Simson, *Philo Math.*

John Smythe, *Accomptant.*

James Thurston, *Ditto.*

To the RECOMMENDERS.

GENTLEMEN,

I Return you hearty thanks for your kind favours
 in honouring me with your names to this small
 Treatise. Your assistance in discovering any errors
 that I have omitted correcting will still further oblige,

GENTLEMEN,

Aug. 24, 1754.

- Your very humble servant,

Daniel Fenning.




A
NEW and EASY
GUIDE, &c.

DIALOGUE I.

Between PHILO, a Tutor, and TYRO, a Pupil, concerning GEOGRAPHY in general.

SECT. I.

Tyro.  YOU have already been so kind, dear *Philo*, as to instruct me in the knowledge of common arithmetic, and the rudiments of algebra, and you promised to instruct me also in the use

use of the globes : if then it be agreeable to you, I should be very glad to learn forthwith.

Philo. With all my heart ; it pleases me much to see you delight in any thing of this sort, rather than spend your time in idleness, which is the parent of mischief ; I am therefore as ready to teach you as you are willing to be taught : but I think it would not be amiss to give you first a little notion of geography, as it will not only the better qualify you for this undertaking, but will be a great help to you for the more ready understanding what you read.

Tyro. I thank you, Sir ; for indeed I have very little notion, and scarce know what you mean by geography ?

Philo. Geography is a science which explains and teaches the properties of the earth, both in respect to land and water.

Tyro. Into how many parts is the earth divided ?

Philo. Into 4 parts, or quarters ; viz.
1. *Europe*, 2. *Asia*, 3. *Africa*, and 4. *America*.

Tyro.

Of GEOGRAPHY. 3

Tyro. What are the other nominal parts of the earth; or how is it yet further divided in relation to land and water?

Philo. Into 10 different names; 5 belonging to the division of land; *viz.* 1. A continent. 2. An island. 3. A promontory or cape. 4. A peninsula. And 5. An isthmus. And these answer to the next 5 belonging to the water; *viz.* 1. An ocean. 2. A lake. 3. A bay. 4. A gulph. And 5. A streight. These answer to each other (as was said before) as more plainly appears by the following description.

LAND.

WATER.

1. A continent is a large tract, or vast extent of main land, not separated by any ocean. Thus *Europe, Asia, Africa, &c.* are continents.

2. An island is a tract of land surrounded with water: as *Great Britain, Ireland, Madagascar, &c.*

3. A promontory, or Cape, is a portion or part of

1. An ocean (or sea) is a large extent or collection of waters, free from land; such as the *Atlantic or Western Ocean, the Indian Ocean, &c.*

2. A lake is a tract of water surrounded by land: as the *Lake of Geneva, the Dead Sea, the Caspian Sea, &c.*

3. A bay is a portion or part of the sea running far up

Of EUROPE.

LAND.

of land running far into the sea; as *Cape Verde*, *Cape of Good Hope*, &c.

4. A peninsula is a part or portion of the earth almost surrounded with water, save only a narrow part or neck of land which ties or unites it to a continent: as *Africa* itself, *Jutland*, &c. &c.

5. An isthmus is a narrow part of land, by which a peninsula is joined to a continent, or main land; as the isthmus of *Panama*, which joins *North* and *South America* together; the isthmus of *Corinth*, &c. &c.

WATER.

up the main land; as the *Bay of Biscay*, *Bay of Siam*, &c.

4. A gulph (or inland sea) is a part of the ocean almost inrounded with land, save some streight or narrow gut of water. by which it has communication with the ocean; as the *Gulph of Arabia*, the *Mediterranean Sea*, &c.

5. A streight is a narrow passage or part of the sea, which joins one sea to another; as the *Streights of Gibraltar*, which joins the *Mediterranean Sea* to the *Atlantick Ocean*; the *Streights of Babelmandel*, &c. &c.



SECT. II.

A further description of the four quarters of the world; and,

I. Of EUROPE.

Tyro. **W**HAT are the principal kingdoms or parts into which *Europe* is divided?

Philo.

Philo. They are 9 in number ; viz.

1. *Scandinavia* (which contains *Sweden* or *Swedeland*, *Denmark*, and *Norway*.)
2. *Moscovia*, or *Russia*. 3. *France*. 4. *Germany*. 5. *Poland*. 6. *Spain*. 7. *Italy*.
8. *Portugal*. And 9. *Turkey*.

Tyro. Pray give me some short account of these in respect of their situation on the globe, and to each other ?

Philo. That I will, my dear pupil ; but it must be but a short account indeed ; just to give you a little idea, and qualify you the better for reading and conversation.

I. Of SCANDINAVIA.

Tyro. What do you mean by *Scandinavia*, and how, or whereabouts is it situate ?

Philo. *Scandinavia* is a large continent, situate between 54 and 72 degrees of N. latitude ; under which name is comprehended the kingdoms of *Sweden*, *Denmark*, and *Norway*, as was said before.

I. SWEDEN.

Tyro. How is *Sweden* situate ?

Philo. *Sweden* is bounded on the N. and E. by *Norway*, on the E. by *Moscovia*, and on the S. by the *Sound*, and part of the *Baltick*. Its metropolis or chief town is *Stockholm*, whose distance from *London* is about $12\frac{3}{4}$ degrees ; viz. 886 miles N. E. The longest day in the most northern parts of this country is about two months, and the shortest in the most southern parts about $6\frac{1}{2}$ hours.

2. DENMARK.

Tyro. How is *Denmark* situate ?

Philo. *Denmark* is bounded on the N. by the *Sound*, on the E. by the *Baltick*, on the S. by part of *Germany*, and on the W. by the *German Ocean*. Its metropolis is *Copenhagen*, whose distance from *London* is 610 miles. N. E. The length of the longest day in the most northern parts of this country is about $17\frac{1}{2}$ hours ;
and

Of EUROPE.

7

and the shortest in the most southern about $8\frac{1}{2}$ hours long.

3. NORWAY.

Tyro. How is *Norway* situate?

Philo. *Norway* is bounded on the N. W. and S. by part of the *Main Ocean*, and on the E. by *Sweden* and the *Gulph of Bothni*, Its metropolis is *Bergen*, whose distance from *London* is about $9\frac{1}{4}$ degrees; viz. 642 miles N. by E. The length of the longest day in the most northern parts is above 2 months, and the shortest in the most southern about $6\frac{1}{2}$ hours.

II. Of MOSCOVIA or RUSSIA.

Tyro. How is *Moscovia* situate?

Philo. *Moscovia* is bounded on the N. by the great *Northern Ocean*, on the E. by *Tartary*, on the W. by *Sweden*, and on the S. by the *Caspian Sea*, and part of *Little Tartary* and *Georgia*. Its length is computed to be about 1250 miles, and breadth about 1100 miles. Its chief province is *Moscovy*, and its metropolis *Mos-*

cow, whose distance from *London* is about 23 degrees; *viz.* is nearly 1600 miles N. E. and about 800 E. of *Cracow*. The longest day in the most northern part of this country is about 2 months, and the shortest in the most southern is about $9\frac{1}{2}$ hours.

III. Of FRANCE.

Tyro. How is *France* situate?

Philo. *France* (called *Gallia*, or the place of the antient *Gauls*) is bounded on the N. by the *English* channel, on the E. by *Germany*, on the S. by part of *Spain* and the *Mediterranean Sea*, and on the W. by the *Bay of Biscay*. Its length is computed to be 550 miles, and the breadth 380. Its metropolis is *Paris*, whose distance from *London* is about 3 degrees S. S. E. *viz.* 210 miles. The length of the longest day in the most northern part of this kingdom is about $16\frac{1}{4}$ hours, and the shortest in the most southern part $9\frac{1}{4}$ hours.

IV. Of

IV. Of GERMANY.

Tyro. How is *Germany* divided?

Philo. *Germany* is in length about 550 miles, and breadth about 510. It is divided into three parts; viz. *Holland*, *Flanders*, and *Upper Germany*.

I. HOLLAND.

Tyro. How is *Holland* situate?

Philo. *Holland* is bounded on the N. by part of the *German Ocean*, on the E. by *Upper Germany*, on the S. by *Flanders*, on the W. and part of the N. by the *German Ocean*. Its metropolis in the N. part is *Amsterdam*, whose distance from *London* is about 210 miles E. and *Rotterdam* on the S. which is about 190 S. E. of *London*.

2. FLANDERS, or SPANISH NETHERLANDS.

Tyro. How is *Flanders* situate?

Philo. *Flanders* is bounded on the N. by *Holland*, on the E. by *Upper Germany*, on the S. by *France*, and on the W. by the *German Ocean*. It has many fair and rich provinces, the metropolis of which is *Antwerp*, whose distance from *London* is about 185 miles E.

3. UPPER GERMANY.

Tyro. What do you mean by *Upper Germany*, and how is it situate?

Philo. *Upper Germany* is part of *Germany* itself, and part of *Gallia* and *Old Italy*. It is bounded on the N. by *Denmark* and part of the *Baltick*, on the E. by *Poland*, on the S. by *Italy*, and on the W. by *France*. Its metropolis is *Cologne*, whose distance from *London* is about 340 miles E.

V. Of

V. Of POLAND.

Tyro. How is *Poland* situate?

Philo. *Poland* is bounded on the N. by part of *Moscovia* and part of the *Baltick*, on the E. by *Little Tartary* and part of *Moscovia*, on the S. by *Hungary*, *Transilvania* and *Moldavia* in *Germany*, and on the W. by *Upper Germany*. Its length is about 600 miles, and breadth about 590. Its metropolis is *Cracow*, whose distance from *London* is $13\frac{1}{2}$ degrees; viz. about 940 miles E. The longest day in the most northern part of this country is about $17\frac{1}{2}$ hours, and the shortest in the most southern about $8\frac{1}{4}$ hours.

Tyro. Is there any other remarkable places belonging to *Poland*?

Philo. Yes, *Prussia*, whose chief town is *Dantzick*; and *Little Russia*, whose chief town is *Lemburg*.

VI. Of SPAIN.

Tyro. How is *Spain* situate?

Philo. *Spain*, formerly called *Iberia Hesperia*, is bounded on the N. by part of *France* and the *Bay of Biscay*, on the E. by the *Mediterranean*, on the S. by the *Streights of Gibraltar*, and on the W. by *Portugal*. Its metropolis is *Madrid*, whose distance is better than 11 degrees; viz. about 780 miles S. by W. of *London*. The longest day in the most northern parts of this kingdom is about $15\frac{1}{4}$ hours, and the shortest in the most southern part is about $9\frac{1}{4}$ hours.

VII. Of PORTUGAL.

Tyro. How is *Portugal* situate?

Philo. *Portugal* is bounded on the N. by part of the *Bay of Biscay*, on the E. by *Spain*, and S. and W. by the *Atlantic Ocean*. Its metropolis is *Lisbon*, whose distance from *London* is better than 14 degrees S. W. by S. viz. about 980 miles. The longest day in the most northern parts

Of EUROPE. 13

parts of this country is about 15 hours, and the shortest in the most southern about $9\frac{3}{4}$ hours.

VIII. Of ITALY.

Tyro. How is *Italy* situate?

Philo. *Italy* is bounded on the N. by part of *Germany*, and on the N. E. by the *Adriatic Sea*, or *Gulph of Venice*, and on the S. and W. by the *Mediterranean* and part of *France*. Its metropolis is the city of *Rome*, the seat of Papacy, and residence of the Pope, the pretended successor of *St. Peter*, and infallible head of the church in all spiritual matters and controversies, as appears by the articles of their faith*. Its distance from *London*

B 5 is

* I confess it is not my business to enter upon any thing foreign to the undertaking; nor did I in the least premeditate upon, or intend it, till I came to this place, in which it may be expected by some (and I think it cannot offend any well-wisher to Protestantism) that I should give a small account of the tenets, or belief, of the ROMISH church. And as I am sensible the emissaries of *Rome* are never wanting, by artifice and cunning, to gain many profelytes to their persuasion (and especially from the established church) I think the digression

is nearly 13 degrees S. E. *viz.* about 903 miles.

Here follows a brief account of the popish creed, or articles of faith, commonly called pope *Pius IVth's* creed.

Note. This creed is divided into 24 articles; the first 12 of which, being the very same as our *Nicene Creed*, I omit, and begin with the 13th article.

Art. 13. *I most firmly admit and embrace the apostolical and ecclesiastical traditions, and all other observations and constitutions in the church of Rome.*

Art. 14. *I do admit the holy scriptures in the same sense that holy mother-church doth, whose business it is to judge of the true sense and interpretation of them; and I will interpret and receive them according to the unanimous consent of the fathers.*

☞ Art.

gression will not be taken amiss: for it may happen, that this small tract may fall into such hands as have not yet heard of their errors and inconsistencies; and if but one out of those many by this means be prevented from falling a sacrifice to their pernicious principles, it will as much answer my design as their welfare.

☞ Art. 15. I do profess and believe that there are seven sacraments of the New Testament, truly and properly so called, instituted by Jesus Christ our Lord, and necessary for the salvation of mankind, tho' not all of them to every one; viz. baptism, confirmation, the eucharist, penance, extreme unction, orders, and marriage: and that they do confer grace; and that of these, baptism, confirmation and orders may not be repealed without sacrilege: I do also receive and admit the received and approved rights of the catholick church, in her solemn administration of the said sacraments.

Art. 16. I do embrace and receive all and every thing that hath been defined and declared by the holy council of Trent, concerning original sin and justification.

☞ N. B. * Art. 17. I do also profess that in the Mass there is offered unto God a true, proper, and propitiatory sacrifice for the quick and the dead; and that in the most holy sacrament of the eucharist there is truly, really, and substantially the body and blood, together with the soul and divinity of our Lord Jesus Christ; and that

there is a conversion made of the whole substance of the bread into the body, and of the whole substance of wine into the blood; which conversion the catholic church calls transubstantiation.

This article is not only blasphemous, but even ridiculous beyond measure, since every one now knows that matter (*viz.* any substance) cannot be in two or more places at one and the same time: therefore let us charitably conclude, that the more learned sort of persons cannot possibly believe this article, though they are bound to give their assent to it.

Art. 18. *I confess under one kind only, whole and entire, Christ and a true sacrament is * taken and received.*

Art. 19. *I do firmly believe that there is a purgatory, and that the souls kept prisoners*

* It is worthy your notice to observe, the verb *is*, in this article is not good grammar; for *Christ* and the sacrament being two distinct things, the verb should be *are*. But to reconcile this with the foregoing article, they have put the verb *is*, to shew that the real body and blood of *Christ*, and the eucharist, are one and the same. This is a cunning, but a wicked and ignorant inconsistency.

soners there do receive help by the suffrages (or prayers) of the faithful.

✚ Art. 20. I do likewise believe that the saints reigning together with Christ are to be worshipped and prayed unto; and they do offer prayers unto God for us; and that their relicks are to be had in veneration.

Art. 21. I do most firmly assert that the images of Christ, of the Blessed Virgin, the Mother of God, and of the other saints, ought to be had and retained, and that due honour and veneration ought to be given them.

Art. 22. I do affirm that the power of indulgencies was left by Christ in the church, and that the use of them is very beneficial to christian people.

Art. 23. I do acknowledge the holy catholic Roman church to be the mother and mistress of all churches; and I do promise and swear true obedience to the bishop of Rome, the successor of St. Peter, the prince of the apostles, and vicar of Jesus Christ.

Art. 24. I do undoubtedly receive and profess all other things which have been delivered, defined, and declared by the sacred canons and occumenical councils, and especially

cially by the holy synod of Trent; and all other things contrary thereunto, and all heresies condemned, rejected, and anathematized by the church, I do likewise condemn, reject, and anathematize.

Consider, Tyro, whether these impositions are consistent with christian liberty.

IX. Of TURKEY in Europe.

Tyro. How is Turkey situate?

Philo. Turkey is bounded on the N. part by Poland, on the E. by the Black Sea, and part of Turkey in Asia, on the S. by part of the Ionian Sea, and on the W. by the Gulf of Venice, and part of Germany. It lies between 36 and 49 degrees N. latitude. Its metropolis is Constantinople, whose distance from London is $23 \frac{3}{4}$ degrees; viz. about 1650 miles E. by S.

The length of this country is about 660 miles, and its breadth about the same. The longest day in the most northern part is about 16 hours, and the shortest

shortest in the most southern about $9\frac{3}{4}$ hours.

The division of TURKEY.

Tyro. Is not *Turkey* divided into different parts or classes.

Philo. Yes, into many, but chiefly into four; viz. 1. *Hungary*. 2. *Greece*. 3. *Little Tartary*, called by some *Crim Tartary*, from a large town. 4. The *Danubian* provinces.

I. HUNGARY.

Hungary, tho' now chiefly under the emperor of *Germany*, is notwithstanding a part of *Turkey*. It is bounded on the N. by part of *Poland*, on the E. by *Transylvania*, on the S. by *Sclavonia*, and on the W. by *Austria*. Its chief city is *Buda*, whose distance from *London* is better than $12\frac{1}{2}$ degrees; viz. about 840 miles S. E.

2. GREECE.

2. GREECE.

Tyro. How is *Greece* situate?

Philo. *Greece* is bounded on the N. by the *Danubian* provinces, on the E. by the *Ægean Sea*, called *Archipelago*, on the S. and W. by the *Mediterranean*. Its chief cities are *Athens* (or *Settines*) and *Adrianople*; the first of which is about 420 miles S. W. of *Constantinople*, and the other about 146 N. W. of the same. *Corinth* is about 54 miles W. of *Athens*, and *Thebes*, or *Stives*, is about 45 N. W. of *Athens*.

3. LITTLE TARTARY.

Tyro. How is *Little Tartary* situate?

Philo. *Little Tartary* is bounded on the N. by part of *Moscovia*, on the E. by *Georgia*, on the S. by the *Black Sea*, and on the W. by *Podolia*.

Its metropolis is *Kaffa*, subject to the *Turks*; it stands near the *Euxine Sea*, about 380 miles N. E. of *Constantinople*, and about 500 miles S. of *Moscow*.

4. Of

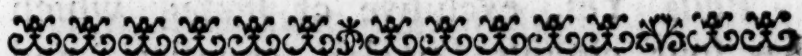
4. *Of the DANUBIAN provinces.*

Tyro. What do you mean by the *Danubian* provinces; and how are they situate?

Philo. They are so called, because they chiefly stand upon, or near the *Danube*, which extends itself from *Kilia*, near the *Black Sea*; to *Vienna* in *Germany*.

Tyro. How many provinces are there?

Philo. Nine; 1. *Transylvania*. 2. *Valachia*. 3. *Moldavia*. 4. *Romania*. 5. *Bulgaria*. 6. *Servia*. 7. *Bosnea*. 8. *Sclavonia*. 9. *Croatia*.



S E C T. III.

Of the EUROPEAN islands; and,

I. *Of ENGLAND.*

Tyro. **H**OW is *England* situate?

Philo. *England* (call'd also *Anglia*, *Britannia*, or *Albion*) is bounded on

on the N. by *Scotland*, on the E. by the *German Ocean*, on the S. by its own channel, which parts it from *France*, and on the W. by *St. George's*, or the *Irish Sea*: it lies between 50 and 56 degrees N. latitude: its length is about 320, and breadth about 290 miles: its metropolis is *London*.

This island contains 38 counties, besides *Middlesex* and *Cheshire*; this last being a county palatine, having the privilege of its own particular judges, counsellors, &c. It has two universities, *Cambridge* and *Oxford*, and 24 bishopricks.

Tyro. Are these all the counties in *England*?

Philo. Yes, exclusive of *Wales*, which has four circuits, twelve counties, and four bishopricks. The longest day in the most northern part is about $17\frac{1}{2}$ hours, and the shortest in the most southern about 8 hours.

II. Of SCOTLAND.

Tyro. How is *Scotland* situate?

Philo. *Scotland* (called also *Caledonia*) is bounded on the N. and W. by the *Baltick Sea*, on the E. by part of the *German Ocean*, and on the S. by *England*. It lies between 55 and 59 degrees N. latitude. Its length is about 240, and breadth about 180 miles, and its metropolis is *Edinburgh*, whose distance from *London* is nearly $4\frac{1}{2}$ degrees; viz. about 300 miles almost N. The longest day in the most northern part of this country is about $18\frac{1}{2}$ hours, and the shortest in the most southern $6\frac{1}{2}$ hours.

III. Of IRELAND.

Tyro. How is *Ireland* situate?

Philo. *Ireland* (called by some *Britannia Parva*, and by others *Hibernia*) is surrounded by the *British Ocean*. It lies between 51 and 55 degrees of N. latitude. The length is about 260, and breadth about 150 miles. Its metropolis is

is *Dublin*, which is distant from *London* nearly $3\frac{1}{2}$ degrees; viz. about 240 miles N. W. The length of the longest day in the most northern part is about $17\frac{3}{4}$ hours, and the length of the shortest in the most southern about $7\frac{3}{4}$ hours.



S E C T. IV.

I. *Of the lesser European islands, and first of such as lie near Great Britain.*

1. *Those on the North are,*

1. **T**HE Orkneys, or Orcades. 2. Shetland.

2. *Those on the East are,*

1. Holy Land. 2. Fern Island. 3. Cocket Island. 4. Sheppy Island. And 5. The Isle of Thanet.

3. *Those on the South are,*

1. Portland Island. 2. The Isle of Wight. 3. Portsea Island.

4. *Those*

4. *Those on the West.*

1. *Lewis Island.* 2. *Skye.* 3. *Mul.*
 4. *Jura.* 5. *Ila.* 6. *Arran.* 7. *Man.*
 8. *Anglesey.* And 9. *Scilly.*

II. *Of other European islands, more distant from Great Britain.*I. *The AZORES.*

These islands lie W. of *England*, and are subject to the king of *Portugal*. They are 9 in number; viz. 1. *St. Michael.* 2. *St. Maria.* 3. *Tercera.* 4. *Gratiosa.* 5. *St. George's.* 6. *Pico.* 7. *Fyal.* 8. *Flores.* And 9. *Cuervo.*

2. *Those of SWEDEN.*

These are 8 in number; viz. 1. *Rugen.* 2. *Bornholm.* 3. *Ocland.* 4. *Gothland.* 5. *Ocfal.* 6. *Dago.* 7. *Aland.* 8. *Ween.*

3. *Those of DENMARK.*

These are 9; viz. 1. *Zealand.* 2. *Funen.* 3. *Langland.* 4. *Laland.* 5. *Falster.* 6. *Mona.* 7. *Femerén.* 8. *Alsén.* And 9. *Iceland.*

4. *Those of NORWAY.*

These are 4; viz. 1. *Carmen.* 2. *Histerén.* 3. *Sanien.* 4. *Suroy.*

5. *MEDITERRANEAN islands.*

Tyro. How many islands go under this name, and how are they situate?

Philo. There are 21 nominal islands, which are situate S. of *Europe* on, or near, the *Mediterranean Sea*; but the following are most noted; viz. 1. *Ytica.* 2. *Minorca.* 3. *Majorca*, situate W. of *Valencia* in *Spain.* 4. *Corfica.* 5. *Sardigna*, lying S. of *Genoa.* 6. *Malta.* 7. *Sicily*, lying S. W. of *Naples.* 8. *Cyprus.* 9. *Candia*, And 10. *Rhodes*, S. of *Antolia* and *Archipelago.*

The

The other small islands, as I have observed, are of little or no signification. Thus much for *Europe*.

Tyro. I heartily thank you, Sir; and now pray give me a little idea of the other part of the world?

Philo. I will, but it must be but a short hint indeed; though I am willing you should have as much instruction as this small tract will allow of. Proceed we then to



D I A L O G U E II.

S E C T. I.

Of A S I A.

Tyro. **I**N what part of the globe is *Asia* situate?

Philo. *Asia*, though called the second, yet is the principal quarter of the globe, lying upon the E. part thereof, and extends itself from 10 degrees S. latitude,
to

to 76 N. latitude, and is divided into 5 principal parts; viz. 1. *Tartary*, 2. *China*. 3. *India*. 4. *Persia*. And 5. *Turkey*.

I. Of TARTARY.

Tyro. How is *Tartary* situate?

Philo. *Tartary* is bounded on the N. by the *Tartarian Ocean*, or *Frozen Sea*, on the E. by the same, and the *Main Ocean*, on the S. by *China*, *India*, and *Persia*, on the W. by *Muscovia* or *Russia*. It lies between 35 and 76 degrees N. latitude, and under the 7. 8. 9. 10. 11. 12. and 13. N. climates; is about 3000 miles long, and 2250 broad, and its chief city is *Cambalie*. The longest day in the most northern part is about 2 months, and the shortest in the most southern about $9\frac{3}{4}$ hours. It is subject to the *Great Cham's* despotic government.

2. Of CHINA.

Tyro. How is *China* situate?

Philo. *China* is bounded on the N. by part of *Tartary*, on the E. by the *Chinese-
sian*

Asian Ocean, on the S. by part of the *Indian Ocean*, on the W. it has *India* without the *Ganges*. It lies between the 4th, 5th, and 6th N. climates, is about 1400 miles long, and 1260 broad, and its chief city is *Pekin*, whose distance from *London* is $70\frac{1}{2}$ degrees; viz. about 4900 miles E. and from *Pekin* to *Nankin* about 690 miles S. E. in the former of which is a bell, 11 feet diameter, and 12 feet high, weighing above $53\frac{1}{4}$ ton. The longest day in the most northern part is about $14\frac{3}{4}$ hours, and the length of the shortest in the most southern is about $10\frac{3}{4}$. It is under the government of the *Great Cham*.

3. Of INDIA.

Tyro. How is *India* situate?

Philo. *India* is bounded on the N. by part of *Tartary*, on the E. by *China*, on the S. by the gulf and bay of *Bengal*, and on the W. by *Persia*. It lies between 9 degrees of S. and 34 of N. latitude. Its length is computed 1680, and breadth much the same, and lies under the 3d, 4th, &c. N. climates. It is divided into

C

3. grand

3 grand parts; viz. 1. The Great Mogul's empire, containing *Delli*, *Agra* (his imperial seat) *Cambaia*, and *Bengal*. 2. *India* within the *Ganges*, whose chief kingdoms are *Decan*, *Golcond*, *Bisnagar*, and *Malabar*.

3. *India* without the *Ganges*, whose chief kingdoms are *Pegu*, *Tonquin*, *Cochinchina*, and *Siam*; this last contains *Martiban Siam*, and *Malucca*, subject to the king of *Pegu*. Length of days and nights much the same as in *China*.

4. Of PERSIA.

Tyro. How is *Persia* situate?

Philo. *Persia* is bounded on the N. by the *Caspian Sea*, on the E. by *India*, on the S. by the *Persian Gulf* and *Indian Ocean*, and on the W. by *Asiatic Turkey*. It lies between 25 and 45 degrees of N. latitude, and under the 3d and 4th N. climates; therefore must of course be exceeding hot for many months in the year. Its length is computed about 1450, breadth 1250. It is divided into 3 parts, N. middle, and S. It is governed by the despotic

despotic power of the *Great Sophy*. They are chiefly *Mahometans*. The longest day in the most northern parts is about $14\frac{3}{4}$ hours, and the shortest in the most southern about $13\frac{1}{4}$ hours.

5. Of TURKEY in ASIA.

Tyro. How is *Turkey* situate?

Philo. *Turkey*, situate in *Asia Minor*, is bounded on the N. by the *Black Sea*, on the E. by *Persia*, on the S. by part of *Africa*, and part of the *Indian Ocean*, on the W. by the *Red Sea*. It lies between 12 and 46 degrees of N. latitude; is computed about 2100 miles long, and 1750 broad. It contains 6 great parts; viz.

1. *Natolia*, whose chief city, or town, is *Bursa*.
2. *Arabia*, whose metropolis is *Midina*.
3. *Syria*, whose capital is *Aleppo*.
4. *Diarbeck*, whose chief city is *Bagdat*.
5. *Turcomania*, whose capital is *Arzerum*.
- And 6. *Georgia*, whose metropolis is *Teflis*.

This vast country is inhabited by *Christians*, *Mahometans*, *Jews*, &c. but is chiefly under the *Ottoman Yoke*.

S E C T. II.

Of the Asiatic islands.

Tyro. **H**OW many islands are here, and how are they situate?

Philo. There are a great number, but they chiefly reduced to these six, whose situation is as follows; 1. *Japan Islands*, E. of *China*. 2. *The Philippine Islands*, S. W. of *Japan*. 3. *The Moluccas*, S. of the *Philippine*. 4. *The Sund*, W. of the *Moluccas*. And 5. *Ceyton*, W. of the *Sund*, whose capital is *Candea*, or *Candy*. And thus much for *Asia*.



D I A L O G U E III.

S E C T. I.

Of AFRICA.

Tyro. **H**OW is *Africa* situate?

Philo. *Africa*, the 3^d quarter of the world, and situate W. on the globe,

globe, is almost surrounded with the *Atlantic, Ethiopian, and Indian Oceans*, and is extended from 35 degrees of S. latitude, to about 35 N. It is principally divided into 8 parts; viz. *Egypt, Barbary, Bildulgerid, Zaara*, called the *Desart, Negro-Land, Guinea, Nubia*, and *Ethiopia*, besides islands.

I. Of EGYPT.

Tyro. How is *Egypt* situate and divided?

Philo. *Egypt* is bounded on the N. by part of the *Mediterranean Sea*, on the E. by the *Isthmus of Fuez* and the *Red Sea*, on the S. by *Nubia*, on the W. by *Barbary* and the *Desart*. It was formerly called *Misraim*. It is divided into *North Erife*, or *Lower Egypt*, whose metropolis is *Sabider*, *Upper Egypt*, whose capital is *Sabid*. And 4. *Red Sea* and its coasts, whose capital is *Cossir*. It lies between 21 and 31 N. latitude, and under the 4th and 5th N. climate, is about 650 miles long, and 300 broad. It is governed by

the *Turkish* emperor, by a *Bassa*, whose dwelling is *Grand Cairo*.

2. Of BARBARY.

Tyro. How is *Barbary* situate?

Philo. *Barbary* is bounded on the N. by part of the *Mediterranean*, on the E. by *Egypt*, on the S. by *Bildulgerid*, and on the W. by part of the *Atlantic Ocean*. Is extended from 29 to 37 degrees of N. latitude, and lies under the 4th and 5th N. climate. Its length is 2300, and breadth 380 miles.

Barbary is divided into 7 different parts, or kingdoms; viz. *Morocco*, *Frez*, *Telensin*, *Algiers*, *Tunis*, *Tripoli*, and *Barca*, whose chief towns are of the same name.

It is chiefly under the government of the *Grand Turk*, and emperor of *Morocco*, who is called also emperor of *Africa*, king of *Morocco*, *Fez*, *Sus*, and *Tassale*; lord of *Gago*, *Dara*, and *Guinea*, and *Great Zeriff* of *Mahomet*, and, consequently, their religion is *Mahometanism*. The longest day $14\frac{1}{4}$ hours, and the shortest $10\frac{1}{2}$ hours, as in *Egypt*.

3. Of

3. Of BILDULGERID.

Tyro. How is *Bildulgerid* situate?

Philo. *Bildulgerid* is situate on the N. by *Barbary*, on the E. by *Egypt*, on the S. by *Zaara*, on the W. by part of the *Atlantic Ocean*. It lies between 29 and 31 degrees of N. latitude, and under the 3d and 4th N. climate. Its length is about 2050, and breadth 300 miles. The length of days is from 14 hours, to 10 $\frac{1}{4}$ hours. It is governed by many little kings, but all subject to the *Great Turk*, or emperor of *Morocco*.

4. Of ZAARA, or the DESART.

Tyro. How is this *Desart* situate?

Philo. *Zaara* is bounded on the N. by *Bildulgerid*, on the E. by *Egypt* and *Nubia*, on the S. by *Negro-Land*, and on the W. by the *Atlantic Ocean*.

It is divided into 7 parts; viz. *Borno*, *Gago*, *Bardoa*, *Lempta*, *Targa*, *Zuenziga*, and *Zanbaga*, whose capital is *Targassa*, the others have the same names as their

Provinces. It lies under 15 and 26 degrees of N. latitude, and under the 3d and 4th climate; is in length 2340, and breadth about 330. The Days are $13\frac{1}{4}$ long, to $10\frac{3}{4}$ hours. Their government is by several lords and kings call *Xequés*, and they are chiefly *Mahometans*.

5. Of NEGRO-LAND.

Tyro. How is the land of *Negroes* situate?

Philo. *Negroë-Land*, bounded on the N. by *Zaara*, on the E. by *Nubia*, on the S. by *Guinea*, on the W. by part of the *Atlantic Ocean*. It lies between 8 and 22 degrees of N. latitude, and under the 2d and 3d N. climate. It is computed to be about 2280 miles long, and 600 broad. It is divided into 13 provinces; viz. *Genoboa*, *Gelata*, *Tombut*, *Agades*, *Cano*, *Cassena*, *Guangara*, *Melli*, *Mandinga*, *Gago*, *Guber*, *Zegzeg*, and *Zanfara*, whose capitals are of the same name. The days are very little different in length from those in *Zaara*. It is governed by several kings, but all, or most, are subject to

to the king of *Tombut*. Gross idolatry and *Mahometism* prevail here.

6. Of GUINEA.

Tyro. How is this country situate?

Philo. *Guinea* is bounded on the N. by *Negro-Land*, on the E. by *Ethiopia Exterior*, on the S. by the *Ethiopian Ocean*, and on the W. by the *Atlantic Ocean*. It is divided into 4 parts; 1. The coast of *Maleguette*, whose capital is *Ti-man*. 2. The *Ivory Coast* westward, whose metropolis is *Toba*. 3. The *Golden Coast* eastward, whose capital is *St. George de Mina*. And 4. The kingdoms of *Benin*, metropolis *Arda*. *Guinea* lies between 5 and 13 degrees of N. latitude. Its length is 1320, and breadth about 400 miles. It is subject to the emperor of *Guinea*, and *Paganism* is here observed to equal height and ridiculous superstition. Their days from $12\frac{3}{4}$ hours, to $11\frac{3}{4}$ hours.

7. Of NUBIA.

Tyro. How is *Nubia* situate?

Philo. *Nubia* is bounded on the N. by *Egypt*, on the E. by *Ethiopia Exterior*, on the S. by *Ethiopia Interior*, on the W. by part of *Zaara* and *Negro-Land*. It lies between 14 and 22 degrees of N. latitude, and under the second and third N. climate. Its length is about 840, and breadth about 570. It is divided by the river *Nubia* into N. and S. The capital of *North Nubia* is *Samna*, and of *South Nubia*, a town, or city of the same name.

It is governed by its own independent powerful prince, who is reported to be very humane. Their traffic is chiefly at *Grand Cairo*. The length of the days are much the same as in *Zaara*.

8. Of ETHIOPIA INTERIOR.

Tyro. How is this country situate?

Philo. *Ethiopia Interior*, called also the land of the *Abissians*, is bounded on the N.
by

by *Nubia*, and on the E. S. and part of the W. by *Ethiopia Exterior*. It lies under the 1st, 2d, and 3d N. and S. climates; and the length is computed 3600 miles, and breadth about 2200. *Ethiopia*

Interior is divided into 8 provinces; viz.

1. *Barnagasso*. 2. *Tigremahon*. 3. *Dobassat*. 4. *Fatigar*. 5. *Angote*. 6. *A-mara*. 7. *Beleguanze*. And 8. *Begra-medri*. This is governed by its own inde-

pendent prince, lord, or ruler, called *Naggasi*, whose government is despotical. He styles himself the beloved of God; (says he sprung from the stock of *Judah*) the son of the column of *Sion*, the son of the seed of *Jacob*, the son of the hand of *Mary*, the son of *Nabu* after the flesh, and of *St. Peter* and *Paul* after the spirit, &c. &c. The longest day in the most northern parts of this country is about 13 $\frac{1}{2}$ hours, and the shortest in the most southern 10 $\frac{1}{2}$ hours.

EXTERIOR.

Ethiopia Exterior is bounded on the N. by *Abyssina*, on the E. W. and S. by

7. Of NUBIA.

Tyro. How is *Nubia* situate?

Philo. *Nubia* is bounded on the N. by *Egypt*, on the E. by *Ethiopia Exterior*, on the S. by *Ethiopia Interior*, on the W. by part of *Zaara* and *Negro-Land*. It lies between 14 and 22 degrees of N. latitude, and under the second and third N. climate. Its length is about 840, and breadth about 570. It is divided by the river *Nubia* into N. and S. The capital of *North Nubia* is *Samna*, and of *South Nubia*, a town, or city of the same name.

It is governed by its own independent powerful prince, who is reported to be very humane. Their traffic is chiefly at *Grand Cairo*. The length of the days are much the same as in *Zaara*.

8. Of ETHIOPIA INTERIOR.

Tyro. How is this country situate?

Philo. *Ethiopia Interior*, called also the land of the *Abissians*, is bounded on the N. by

by *Nubia*, and on the E. S. and part of the W. by *Ethiopia Exterior*. It lies under the 1st, 2d, and 3d N. and S. climates; and the length is computed 3600 miles, and breadth about 2200. *Ethiopia*

Interior is divided into 8 provinces; viz.

1. *Barnagasso*. 2. *Tigremahon*. 3. *Dobassat*. 4. *Fatigar*. 5. *Angote*. 6. *A-mara*. 7. *Beleguanze*. And 8. *Begramedri*. This is governed by its own inde-

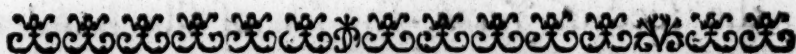
pendent prince, lord, or ruler, called *Naggasi*, whose government is despotical. He styles himself the beloved of God; (says he sprung from the stock of *Judah*) the son of the column of *Sion*, the son of the seed of *Jacob*, the son of the hand of *Mary*, the son of *Nabu* after the flesh, and of *St. Peter* and *Paul* after the spirit, &c. &c. The longest day in the most northern parts of this country is about 13 $\frac{1}{2}$ hours, and the shortest in the most southern 10 $\frac{1}{2}$ hours.

EXTERIOR.

Ethiopia Exterior is bounded on the N. by *Abyssina*, on the E. W. and S. by

Ethiopic Ocean. And, if to this you take in the land of the *Hottentots*, it extends to near 35 degrees S. latitude. It comprehends the kingdoms of *Biafara*, *Loango*, *Congo*, and *Angola*; the empires of *Monnemungi* and *Monopotapa*; and the coasts of *Cafres*, *Zanguebar*, *Ajan*, and *Abex*. It is governed by various princes, and the people are chiefly gross *Idolaters* and *Mahometans*. As for the *Hottentots*, they shew no sign of any devotion, only very superstitious.

The days much as in *Ethiopia Interior*.



S E C T. II.

Of the AFRICAN Islands.

Tyro. **W**HAT are the principal islands in *Africa*?

Philo. There are many small islands; but the most noted are comprehended under 4 names; viz. 1. The island of
8 *Madagascar.*

Madagascar. 2. *Cape Verde Islands.* 3. *The Canary.* And, 4. *the Madeira islands.*

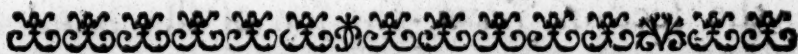
I. MADAGASCAR.

This is a large island, lying S.E. of *Ethiopia*, and extends from 11 to about 25 of S. latitude; is about 1000 miles long, and 400 broad. It is called by the *Portuguese St. Laurence*, because they first discovered it on that day. The inhabitants (except in the eastern part) are chiefly *Pagans* and *Mahometans*; and are so governed by their priests (called *Ombiaffes*) that they are under uncommon superstitions. Thus, if a child be born upon such a day, they say it is unlucky, and, therefore, give it to the wild beasts; and, if a woman dies in childbed, they bury the living child with her, because it is better so (they say) than to live without a mother to take care of it. And thus, by these priest-cunning and delusive persuasions, their island is very thin of inhabitants. It is under no particular governor.

2. *Cape*

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2. *Cape*

2. *Cape VERDE islands.*

These lie S. W. of *Barbary*, and N. W. of *Guinea*, between 13 and 17 degrees N. latitude, and are as follows;

1. *St. Anthony.* 2. *St. Vincent.* 3. *St. Zucia.* 4. *St. Nicholas.* 5. *Insula de Sal.* 6. *Bonavista.* 7. *Mago.* 8. *St. Jago.* 9. *Insula del Fuego.* 10. *Brava.*
- The chief town is *St. Jago*, subject to *Portugal*.

3. The CANARY *islands.*

These lie N. of *Cape Verde* islands, and under 27 and 29 N. latitude. They are 7 in number; viz. 1. *Lancerota.* 2. *Forté Ventura.* 3. *Canaria.* (Metropolis the same.) 4. *Teneriffe*, famous for its peak, and the first meridian in the *French* maps. 5. *Gomera.* 6. *Ferro.* And 7. *Palma.* They are subject to the king of *Spain*.

4. MADEIRA,

4. MADEIRA, or MADEIRAS.

This lies in about 32 degrees N. latitude, and W. of *Morocco*. Its chief town is *Tonzal*. It is subject to the *Portuguese*.

Tyro. Are these all the islands?

Philo. There are some of less note; viz. 1. *Zocotora*, subject to the *Arabians*. 2. *Comoro*, N. W. of *Madagascar*. 3. *St. Thomas*. 4. *Prince's Island*. And 5. *Annobon*, subject to the *Portuguese*, lying W. of *Ethiopia*. 6. *St. Helena*, subject to the *English*, lying S. W. of *St. Thomas's*. And 7. *The Isle of Ascension*, N. E. of *St. Helena*. Thus much for *Africa*.

Tyro. I return you thanks, Sir.

Philo. Now, *Tyro*, for the last quarter of the world; viz. *America*.

DIALOGUE

DIALOGUE IV.

S E C T. I.

Of AMERICA.

Tyro. **W**HAT is *America* called, and how is it situate?

Tyro. America, called the 4th, or last quarter of the world, and westward on the globe.

It is divided into 2 principal parts, one called *North*, and the other *South America*.

I. *Of* NORTH AMERICA.

Tyro. Why is this called *North America*.

Philo. Because it lies on the N. side,
or northward of the equator.

Tyro. Into how many principal parts is this divided?

Philo.

Of N. A M E R I C A. 45

Philo. Into 5, as follows; viz. 1. *Mexico*, or *New Spain*. 2. *New Mexico*, called *Granada*. 3. *Florida*. 4. *Terra Canadensis*. And 5. *Terra Arctica*.

1. Of MEXICO, or NEW SPAIN.

Tyro. How is this country situate?

Philo. *Mexico*, discovered in 1518, and conquered by the *Spaniards* in 1521, is bounded on the N. by *Nova Granada*, on the E. by the gulph of *Mexico*, on the W. by *Mare del Zur*, or *Pacific Ocean*, and on the S. by *Terra Firma*. It lies chiefly in the frigid zone, between 8 and 30 degrees of N. latitude, and is extended to about 38 degrees of longitude. The greatest length is computed to be 2530, and breadth about 480.

Tyro. Into how many principal parts is this country divided?

Philo. Into 3, called *Audiences*; viz. 1. *Guadalajara*, whose metropolis is the same. 2. *Mexico*. Metropolis the same. And 3. *Guatalama*, metropolis *St. Jago de Guat*.

I. GUADALA-

I. GUADALAJARA.

This contains the provinces of *Cinaola*, *New Biscay*, *Zazaticas*, *Guadalajara*, *Chiameltan*, and *Zalisco*.

2. *Mexico* contains the provinces of *Panuco*, *Mexico*, *Mechoachan*, *Los Angeles*, *Anlequera*, *Tabasco*, and *Jucatan*.

3. *Guatalama* comprehends *Soco Nufco*, *Guatalama*, *Nicaragua*, *Costa*, *Rica*, *Veragua*, *Honduras*, *Vara*, *Pax*, and *Chiapa*. The longest day in the most northern part of this country is about $13 \frac{1}{2}$ hours, and in the most southern about $12 \frac{1}{2}$ hours. It is governed by the king of *Spain*, under a vice-roy, who resides at *Mexico*. There are *Pagans*, *Idolaters*, &c. in some parts; but the natives adhere, as in *Spain*, to the most strict order of *Papacy*.

2. Of NEW MEXICO called NOVA GRANADA.

Tyro. How is this part of *North America* situate?

Philo.

Of N. A M E R I C A.

47

Philo. This country was discovered by the *Spaniards*, 1540, and is bounded on the N. by *Terra Arctica*, on the E. by *Florida*, on the S. by *Mexico*, or *New Spain*, and on the W. by *California*. Its bounds are not yet known. The chief town is *Santa Feé*, the residence of the *Spanish* governor.

3. Of FLORIDA.

Tyro. How is this country situate?

Philo. *Florida*, discovered also by the *Spaniards*, 1497, and possessed by them, 1527, is bounded on the N. by part of *Terra Arctica*, on the E. by *Carolina*, or part of *Terra Canadensis*, on the S. by part of *Mexico* and the *Gulph*, and on the W. by *Mexico* and *California*. It lies between 25 and 30 degrees of N. latitude, and under the 5th and 6th N. climate, is extended to 23 degrees in longitude, and computed to be about 1000 miles long, and 600 broad, in its greatest length and breath.

The natives are gross idolaters, and the main part is governed by several distinct lords,

lords, or rulers: but the places upon, or near the sea coasts, are subject to the *Spaniards*. The longest day in the most northern part is about $14 \frac{1}{4}$ hours, and the shortest in the most southern about 9 hours.

Its metropolis is *Coca*.

4. Of TERRA CANADENSIS.

Tyro. How is this situate, and why so called?

Philo. It takes its name from the river *Canada*. It is bounded on the N. by part of *Terra Arctica*, on the E. by the *Atlantic Ocean*, on the S. by part of the sea and the island of *Cuba*, and on the W. by *Florida*, *Canada*, &c. It lies between 30 and 62 degrees of N. latitude, and extends to near 40 degrees of longitude: is about 1800 in length, and 1210 in breadth.

Tyro. But pray, is it not divided into some principal parts?

Philo. Yes, into N. and S. The N. comprehends, 1. *Terra Canadensis Propria*. 2. *Nova Britannica*, or *New Britain*.

tain. 3. *Nova Francia*, or *New France*.
Chief town *Quebeck*.

Tyro. What does the S. part contain?

Philo. 1. *Nova-Scotia*. 2. *New Eng-land*. 3. *New York*. 4. *New Jersey*, E. and W. 5. *Pensilvania*. 6. *Mary-land*. 7. *Virginia*. And 8. *Carolina*, all in the possession of, and subject to, the crown of *Great Britain*.

The metropolis of these towns in order are, 1. *Hallifax* in *Nova-Scotia*. 2. *Boston*. 3. *New York*. 4. *Elizabeth*. 5. *Philadelphia*. 6. *Annapolis Royal*. 7. *James Town*. And 8. *Charles Town*.

N. B. These lie one after another in order from N. to S.

1. *Nova-Scotia*, discovered 1622.

2. *New England*, in 1497, and possessed for queen *Elizabeth*, by Sir *Philip Amadas*, 1558.

3. *New York*, by Mr. *Hudson*, 1608, and sold to the *Dutch*, who kept it till 1664; at last it was given by *Charles II.* to the duke of *York*; it was called before *New Netherland*.

4. *New*

4. *New Jersey*, was discovered in 1497.

5. *Pensilvania*, about the same time, was given by *Charles II.* to *William Penn*, Esq; by letters patent in 1680.

6. *Virginia*, in 1427, but more particularly in 1584, by Sir *Walter Raleigh* (who is said to be the first that brought tobacco over) for queen *Elizabeth*. Thus called in honour to her as virgin queen.

7. *Maryland*, was also discovered by the *English* under the two *Cabots*, 1497, is bounded on the S. by *Virginia*. It has its name from *Mary*, wife of *Charles I.* who gave it by letters patent under that name to the right honourable *Cæcilius Calvert*, lord *Baltimore*, 1632.

8. *Carolina*, discovered about the time with *Virginia*, and in 1660 granted by patent to several noblemen, by *Charles II.*

5. Of TERRA ARCTICA.

Tyro. What do you mean by this name?

Philo. It is called *Arctica*, because *Arctic* is N. therefore it comprehends

I. Of

those countries of *America* situate near, or towards, the N. pole, or polar circles.

Tyro. Which be they?

Philo. There are many of them; but the chief, and most noted are, 1. *Greenland.* 2. *Spitsberg.* 3. *Nova Zembla.* 4. *Terra de Jesso.* 5. *New Denmark.* And 6. *New North Wales.*

These are known very little of at present, but barely their names, therefore cannot be taken any further notice of.

II. Of S O U T H A M E R I C A.

Tyro. Why is this so called?

Philo. Because it lies chiefly on the S. side of the equator.

Tyro. Into how many principal parts is it divided?

Philo. Into 8; viz. 1. *Terra Firma.* 2. *Peru.* 3. *The Land of the Amazons.* 4. *Brazil.* 5. *Chili.* 6. *Paraguay.* 7. *Terra Magellanica.* And 8. *Terra Ant-
arctica.*

1. Of

I. Of T E R R A F I R M A.

Tyro. How is this situate?

Philo. *Terra Firma* was discovered in 1514, lies under the 1st N. climate, and is bounded on the N. by part of *Mexico*, on the E. by part of the *Atlantic*, on the S. by *Peru* and part of *Brasil*, and on the W. by *Mar del Zur*. It is extended to about $27\frac{1}{2}$ degrees longitude, and lies under from 1 to $11\frac{1}{2}$ degrees N. latitude. It is computed to be about 1500 miles long, and 750 miles broad.

Tyro. How is it divided?

Philo. Into E. and W. The E. upon the river *Orinoque*, called 1. *Guian*, whose chief town is *Manboa*. And 2. *Caribana*, whose metropolis is *Moresbego*. The W. comprehends the provinces of

1. *Panama*, called also *Terra Firma*; chief town is *Panama*.

2. *Carthagena*, metropolis the same.

3. *St. Martha*, metropolis the same.

4. *Rio de la Hacha*, metropolis the same.

5. *Andaluzia*, metropolis *Comana*.

6. *Paria*,

6. *Paria*, metropolis *Maluregvara*.

7. *Granada*, metropolis *St. Feé de Bagato*.

8. *Papayan*, metropolis *St. Feé de Antiochia*.

It is governed by the king of *Spain*, by a vice-roy residing at *Mexico*. The natives of this country, especially in the middle, are gross idolaters.

2. Of P E R U.

Tyro. How is this country situate?

Philo. *Peru*, first discovered by the *Spaniards*, 1525, is bounded on the N. by part of *Terra Firma*, on the E. by *Amazonia*, on the S. by *Chili*, and on the W. by *Mar del Zur*. It lies between 24 degrees of S. and 1 degree of N. latitude, and is extended to 20 degrees of longitude, and under the 1st, 2d, and 3d S. climate.

Tyro. How is it divided?

Philo. Into 6 provinces.

1. *Posto*, whose metropolis is *Posten*.

2. *Los Quixos*, whose metropolis is *Baesfa*.

D

3. *Paca-*

54 Of S. A M E R I C A.

3. *Pacamores*, whose metropolis is *Valdadolid*.

4. *Quito*, metropolis *Quito*.

5. *Peru*, metropolis was *Lima*.

6. *Los Carcas*, metropolis *Potosi*.

The natives in general are very gross idolaters, worshipping sun, moon, stars, thunder, lightning, &c. But in some parts there are christians, &c.

It was quite conquered by the *Spaniards* in 1533, and they have the most considerable part of it under their government.

3. Of the Land of the AMAZONS.

Tyro. How is this land situate?

Philo. This country, discovered by the *Spaniards* in 1541, is bounded on the N. by *Terra Firma*, on the E. by *Brasil*, on the S. by *Paraguay*, and on the W. by *Peru*.

It lies under the 1st, 2d, and 3d S. climate. It is under no particular government: the inhabitants in general being a savage sort of people, appearing always in arms. It is supposed to take

its name from those warlike women called (by several poets and historians) *Amazons*, of whom it is reported they cut off one of their breasts, not only for the better qualifying themselves to hold their bows, and shoot the surer, but that they might be the more savage and rapacious.

4. Of BRASIL.

Tyro. How is *Brasil* situate?

Philo. This country, discovered by the *Portuguese*, in about 1501, is bounded on the N. by *Terra Firma*, on the E. by the *Atlantic Ocean*, on the S. by *Paraguay* and part of the *Main Ocean*, and on the W. by the land of the *Amazons*.

It lies between 1 and 23 degrees of S. latitude, and under the 1st, 2d, 3d, and 4th S. climate.

Its greatest length is computed about 1600 miles, and its breadth about 1380.

Tyro. Into how many principal parts is it divided?

56 Of S. A M E R I C A.

Philo. There is not any particular account of its provinces, divisions, &c. but the chief towns that are known, or most worthy of note, are as follows, 1. *St. Vincent.* 2. *Sanctos.* 3. *Angra Dos Reyes.* 4. *St. Sebastian.* 5. *Spiritu Sancto.* 6. *Porto Seguro.* 7. *St. Salvadore.* 8. *Per-nambuco.* And 9. *Parayba.*

They are under no particular government nor religion, being chiefly sunk into all ignorance, idolatry, &c.

5. Of C H I L I.

Tyro. How is this country situate?

Philo. *Chili*, discovered by the *Spaniards* about 1554, is bounded on the N. by *Peru*, on the E. by *Paraguay*, on the S. by *Terra Magellanica*, and on the W. by the *Pacific Ocean*.

It lies between 25 and 44 degrees of S. latitude, and under the 4th, 5th, and 6th S. climate.

Its length is computed to be about 1100 miles.

Tyro. Into how many parts is *Chili* principally divided?

Philo.

Philo. Into 3 ; viz. 1. *Chili Propria.* 2. *Chili Imperial.* And 3. *Chucuito*, whose chief towns are *St. Jago*, *Balvida*, and *Mandosa*.

Though I am not upon history, *Tyro*, yet it may be some satisfaction to tell you there is in several places in this country, a prodigious large, ravenous and carnivorous bird, called a *Conter*, which (as several historians report) will seize, and soon destroy, and eat a sheep, or small calf; and two of them will attack a cow, or any large tame beast.

It is chiefly governed by the vice-roy of *Peru*, under the king of *Spain*.

6. Of PARAGUAY.

Tyro. How is *Paraguay* situate?

Philo. This country, discovered also by the *Spaniards* in 1546, is bounded on the N. by the land of the *Amazons* and part of the ocean, on the E. by the *Atlantic Ocean*, on the S. by the *Southern Ocean* and *Terra Magellanica*.

Tyro. Whence has it its name?

58 Of S. A M E R I C A.

Philo. From the river *Paraguay*; but it is called by the *Spaniards* (and currently by others) *Rio de la Plata*.

It lies between 18 and 37 degrees of S. latitude, and under the 2d, 3d, 4th, and 5th S. climate, and extends to about 32 degrees of longitude.

Its length is computed about 1200 miles, and breadth about 1100 miles.

Tyro. Into how many principal parts is it divided?

Philo. The most material provinces are 5 in number; viz. 1. *Guayra*, whose chief town is *Cividad Real*. 2. *Paragaia Propria*, whose chief town is *Villa Rica*. 3. *Chaco*, whose chief town is *Conception*. 4. *Tucuman*, whose chief town is *St. Jago*. And 5. *Rio de la Plata*, whose chief town is *Assumption*. It is governed chiefly by a vice-roy.

7. Of TERRA MAGELLANICA.

Tyro. How is this country situate?

Philo. It is bounded on the N. by part of *Paraguay* and *Chili*, on the E. by the
Atlantic,

Atlantic, on the S. by *Terra Antarctica*, and on the W. and S. by the *Great South Sea*.

It was discovered about 1519, by one *Ferdinand Magellan*, from whom it took its name?

8. Of TERRA ANTARCTICA.

Tyro. How is this country situate, and why so called?

Philo. *Terra Antarctica* signifies those countries that lie between the *Antarctic* circle and the S. pole; the chief of which known are *New Zealand*, *New Guinea*, *New Holland*, and *Terra Australis Incognita*. And now, *Tyro*, we proceed to



S E C T. II.

Of the AMERICAN *islands.*

Tyro. WHAT are the principal *islands* in *America*?

D 4

Philo.

Philo. They are 10, which are thus divided :

1. To the N. are		{ 1. <i>California</i> 2. <i>Newfound-</i> <i>land.</i>
2. <i>Middle the</i> <i>Antilles</i>	<i>Greater</i>	{ 3. <i>Cuba.</i> 4. <i>Jamaica.</i> 5. <i>Hispaniola.</i> 6. <i>Porto Rico.</i>
3. To the S. are	<i>Lesser</i>	{ 7. <i>Caribees.</i> 8. <i>Lucayes.</i> 9. <i>Sotovento.</i> 10. <i>Bermudas.</i> 11. <i>The Island</i> <i>of Terra del</i> <i>Fuego.</i>

I. *Of* CALIFORNIA.

This island was once thought to be a peninsula, the N. part was discovered by Sir *Francis Drake* in 1577. It has *Mexico* on the E. and the *Pacific Ocean* on the W. it lies 35 degrees N. latitude.

2. *Of*

2. *Of* NEWFOUNDLAND.

This island was discovered by the two *Cabots*, in the time of *Henry VII.* 1497; but more perfectly by *Thorn* and *Elcot* of *Bristol*, in 1527. It lies between 47 and 51 degrees of N. latitude, near *New Britain.*

Avalon is its chief *Province*, which was built upon by *Sir George Calvert* in 1623, by a patent granted, and afterwards enjoy'd by *Cæcilius* lord *Baltimore.* It is subject to the crown of *England.*

3. *Of* CUBA.

This island was discovered by the *Spaniards* in 1594. It lies N. of *Jamaica*, N. W. of *Hispaniola*, and S. of the *Babama islands.* It lies between 19 and 23 degrees N. latitude, and extends to about 8 degrees of longitude. It is subject to the king of *Spain*, and the chief towns are the *Havanna* and *St. Jago.*

AMERICAN *Islands.*4. *Of JAMAICA.*

This was discovered by one *Columbus*, and possessed by *Penn* and *Venables* in *Oliver's* time. It was first called *St. Jago*, but afterwards *Jamaica*, in honour of *James* duke of *York*.

It lies S. of *Cuba*, and W. of *Hispaniola*, and between 18 and $19\frac{1}{4}$ latitude, and extends to about $\frac{3}{2}$ degrees of longitude.

It is subject to the *English*. Its chief town is *Port Royal*.

5. *Of HISPANIOLA.*

This was discovered also by *Columbus* in 1492. It lies between 17 and 20 degrees of N. latitude. It has *Cuba* on the N. W. *Jamaica* on the W. and *Porto Rico* on the E. It is chiefly subject to the crown of *Spain*; and its principal town is *St. Domingo*.

6. *Of*

6. Of PORTO RICO:

Porto Rico (once called *J. bannis In-sula*, and by the natives *Bonquin*) lies E. of *Jamaica*, about 18 N. latitude. It takes its name from the city and haven of the same name.

7. Of the CARIBBEE *islands.*

Tyro. Why are these islands so called?

Philo. From the inhabitants, who upon first discovery were found to be *Cannibals*, and the word is taken for the same. They represent the segment of a circle, are about 30 in number, and extend from about 17 degrees N. almost to *Terra Firma*.

The chief among them are, 1. *Anguila*. 2. *St. Martin*. 3. *Sancta Crux*. 4. *Barbada*. 5. *St. Christopher's*. 6. *Nevis*, or *Mevis*. 7. *Antego*. 8. *Montserrat*. 9. *Guadalupa*. 10. *Marigalant*. 11. *Dominica*. 12. *Martinico*. 13. *Barbadoes*. 14. *St. Lucia*. 15. *St. Vincent*. 16. *Grenada*. And 17. *Tabago*.

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Tyro. Why are these islands so called?

Philo. From the inhabitants, who upon first discovery were found to be *Cannibals*, and the word is taken for the same. They represent the segment of a circle, are about 30 in number, and extend from about 17 degrees N. almost to *Terra Firma*.

The chief among them are, 1. *Anguila*. 2. *St. Martin*. 3. *Sancta Crux*. 4. *Barbada*. 5. *St. Christopher's*. 6. *Nevis*, or *Mevis*. 7. *Antego*. 8. *Montserrat*. 9. *Guadalupa*. 10. *Marigalant*. 11. *Dominica*. 12. *Martinico*. 13. *Barbadoes*. 14. *St. Lucia*. 15. *St. Vincent*. 16. *Grenada*. And 17. *Tabago*.

Note. Some of these belong to the *English*, some to the *French*, and others to the *Dutch*. The chief of these is *Barbadoes*, about $13 \frac{1}{2}$ degrees N. latitude. It is subject to the *English*.

8. *Of the* LUCAYES.

Tyro. Why are these so called?

Philo. From *Lucayone*, the longest of them all. They extend from *Tegesta* in *Florida*, to the N. of *Hispaniola*.

The chief of which are, 1. *Bahama*.
2. *Lucayone*. 3. *Cignatio*. 4. *Guana-*
hani. 5. *Tuma*. 6. *Tama*. 7. *Samana*.
And 8. *Maiaguana*.

The principal of these is *Bahama*, near *Cape Florida*, and remarkable for spiders, they being about 2 inches long in general, having 6 eyes.

9. *Of the* SOTOVENTO.

These are so called by the *Spaniards*, to whom they chiefly belong, and are found from E. to W. along the coast of
Terra

Terra Firma. The principal of them are, 1. *Tinidada.* 2. *Margarita.* 3. *Fortuga.* 4. *Orchilla.* 5. *Rocca.* 6. *Bonayre.* 7. *Curacao.* And 8. *Oruba.*

10. BERMUDAS.

Bermudas, so called from *John Bermudas*, a Spaniard, who first discovered it. It lies between 32 and 33 degrees of N. latitude, E. of *Carolina*; viz. about 240 *English* leagues, and is subject to the crown of *Great Britain*.

11. Of TERRA DEL FUEGO.

This (according to several *Historians*) is so called, on account of several volcanos. It is situate S. of *Magellanica*, and parted from the main continent by the *Streights of Magellan*, lying between 52 and 53 degrees S. latitude.

And thus, *Tyro*, I have given you a short and concise account of every thing, as far as I could in this compass, and is sufficient (if well understood) to satisfy the curiosity of any reader that is willing to

to improve himself by authors, qualifying him the better for those that have treated more largely and particularly upon them.

And now, *Tyro*, we are come to that part in which I proposed to teach you the use of the globes, called by some practical, by others experimental geography.



D I A L O G U E V.

Between PHILLO, a Tutor, and TYRO, his Pupil, concerning the nature, description, and use of the GLOBES.

S E C T. I.

Tyro. **W**HAT is a globe, or sphere?
Philo. A globe, or sphere, is a solid round body, contained under one surface; having a point in the middle, called the center, from whence all lines drawn to the surface are equal.

Tyro.

Tyro. Pray how is a *Globe* generated or formed?

Philo. It is made by the rotation of a circle, or semi-circle, broad ways upon their axis: that is, a shilling, &c. pressed upon its edge, by two pins opposite each other, and blown round, will naturally represent the formation, or shape of a globe.

Tyro. How many sorts are there?

Philo. Two, one called the *Terrestrial*, or earthly; the other the *Celestial*, or heavenly globe.

Tyro. What does the *Terrestrial Globe* teach us?

Philo. By the *Terrestrial Globe* we are taught the knowledge of earth and sea; with the situation of places, their difference in latitude and longitude, and sun rising and setting; length of days and nights throughout the year, and the true distance from one place to another, &c. called *Geography*.

Tyro. What is the use of the *Celestial Globe*?

Philo. The *Celestial Globe*, not only teaches us the sun's, but also the rising and setting

setting of the stars, together with their right *Ascension*, *Declination*, *Amplitude*, *Almicater*, *Azimuth*, *Latitude*, *Longitude*, and distance from each other, &c. called *Astronomy*.

Tyro. But I must know first what *Almicater*, *Azimuth*, &c. mean.

Philo. That you shall know by and by : but first, you must learn the name of the appendants and different circles belonging to the *Globe*.

Tyro. Please then to let me know what they be ?

Philo. I will, and only give yourself a little pains to learn the nature of them, and you will immediately be qualified to work some *Problems* directly.



S E C T. II.

A further description of the Globes, with the great circles and appendants belonging.

Tyro. **W**HAT do you mean by great circles of the *Sphere*?

Philo.

Philo. Great circles are such as cut the globe into two equal parts, passing through the center: all such as do not cut the sphere in two equal parts, are called *lesser circles*.

Tyro. Pray how many are the great circles?

Philo. The *Equator*, or *Equinoctial*, the *Ecliptic*, or *Zodiac*, the *Brazen Meridian*, the *Horizon*, and the *Colures*.

I. Of the EQUATOR.

Tyro. What is the *Equator*, or *Equinoctial*?

Philo. The *Equator* on the *Terrestrial*, or *Equinoctial* on the *Celestial Globe*, is a line, or circle, that cuts the *Globe* in two equal parts, dividing the N. from the S. and upon the *Globe* is easily known by two broad lines running parallel to each other, and a fine hair line between them: it is divided into 360 equal parts, called degrees, beginning at the first meridian (or sign *Aries*) and is marked from 1 with 10, 20, 30, 40, &c. to 360, quite round.

Tyro.

Tyro. But there are other figures on the lower edge, or part of the *Equator* on the *Terrestrial Globe*; are there not?

Philo. Not on all *Globes*. *Senex's* globes, indeed (which, as I said before, I would recommend) are also marked, from the meridian of *London*, with 10, 20, 30, &c. to 180 degrees to the right-hand, or E. and backwards from *London*, with 10, 20, 30, &c. to 180, W.

Tyro. And, pray, what is the use of this?

Philo. The *Equator* shews you the longitude of any place, either E. or W. from the first meridian; and this lower line on *Senex's* globe shews you the longitude of any place from *London*, which is very ready, easy, and useful. The *Equinoctial* is to shew the right and oblique ascension, &c. of the sun, or any star, &c.

2. Of the ECLIPTIC and ZODIAE.

Tyro. What, or which is the *Ecliptic*?

Philo. The *Ecliptic* is another great circle of the sphere, which cuts the *Equator*

tor at the two points, *Aries* and *Libra*, making an angle at each point of 23 degrees, 30 minutes, which is its furthest, or utmost extent, either N. or S. from the *Equator*, as you will see more plainly hereafter.

Tyro. What is the *Zodiac*?

Philo. The *Zodiac* is a broad imaginary circle, which extends itself (according to the rules of *Astronomy*) eight degrees on each side of the *Ecliptic*, and is that which contains the 12 signs, and in which the planets perform their revolutions. The line in the middle drawn parallel, is called the *Ecliptic*; because *Eclipses* happen in, or near the line. It is called *Via Solis*, the *Sun's Path, Way, or Motion*. ☞ Tho' in modern *Astronomy*, it is that circle, or path, that the earth describes to an eye, placed in the center of the system, viz. the sun.

Tyro. Pray, Sir, tell me in what manner the *Ecliptic* is divided, for, I think, I have some notion of it?

Philo. The *Ecliptic* (like the *Equator*) is divided into 360 degrees, but not numbered from 1, 10, &c. as the *Equator*

Equator is, but is divided into 12 equal parts, containing 30 degrees each, which are called *Signs*, and have different *Names* and *Characters*.

Tyro. Please to let me know them?

Philo. I will, and you must mind to get the names of them by heart, and the character belonging to each, so as to know them at first sight.

The S I G N S.

NORTHERN SIGNS.

<i>Aries.</i>	<i>Taurus.</i>	<i>Gemini.</i>	<i>Cancer.</i>	<i>Leo.</i>	<i>Virgo.</i>
♈	♉	♊	♋	♌	♍

SOUTHERN.

<i>Libra.</i>	<i>Scorpio.</i>	<i>Sagittarius.</i>	<i>Capricorn.</i>	<i>Aquarius.</i>	<i>Pisces.</i>
♎	♏	♐	♑	♒	♓

☞ Take notice the first six are called the *Northern*, the other the *Southern Signs*, and you are to mind which are opposite to each other (for that is very material) as ♈ is opposite to ♎, ♉ to ♊, ♋ to ♌, &c. for it will shew you the different times

times and seasons of the year, &c. very readily, when you come to perform any operation.

Tyro. I will observe what you say, but please to tell me the signification of their names?

Philo. It is of no great service; however, *Aries* γ , or the *Ram*; *Taurus* δ the *Bull*; *Gemini* π the *Twins*; *Cancer* ϵ the *Crab*; *Leo* ζ the *Lion*; *Virgo* ν the *Virgin*; *Libra* ζ the *Scales*; *Scorpio* ι the *Scorpion*; *Sagittarius* σ the *Archer*; *Capricorn* \wp the *Goat*; *Aquarius* ♒ the *Water-pot*; and *Pisces* ♓ the *Fishes*.

N. B. The *Ecliptic* cuts, or intersects the *Equator*, or *Equinoctial*, at the two points, or signs, *Aries* γ and *Libra* ζ , viz. on the 21st of *March*, and the 22d of *September*, N. S. on which days the sun is in the *Equator*, and has no declination, either N. or S. and days and nights are then equal to all the inhabitants on the globe, as you will plainly see by and by.

3. Of the BRAZEN MERIDIAN.

Tyro. What is the *Brazen Meridian*?

Philo. The *Brazen Meridian* is another great circle, which divides the *Globe* into two equal parts. It is represented by a thick *Brass-hoop*, which surrounds the *Globe*, from N. to S. and divides the *Equator* into 2 equal parts, viz. the E. from the W. and is that on which the *Globe* itself is hung, or turns round upon by its *Axis*, the extremities of which are called the poles.

Tyro. How is the *Brazen Meridian* marked, or divided?

Philo. Like the *Equator* and *Ecliptic*, into 360 degrees; but with this difference, it is divided into 4 nineties.

Tyro. In what manner pray?

Philo. From the *Equator* towards the N. and S. pole, the *Meridian* is marked with a cypher over the *Equator* thus, (o) and on each side, with 10, 20, 30, 40, 50, 60, 70, 80, and 90, which ends in each pole. Then again, from each pole to the *Equator* on the other half of the *Meridian*,

Meridian, is marked 10, 20, 30, 40, &c. to 90, which ends in the *Equator*.

Tyro. Then I plainly perceive by this, that as many degrees as one pole is elevated or raised, the same will the contrary pole be depressed?

Philo. Your notion is very just.

Tyro. But, pray, what is the principal use of this circle?

Philo. The *Brazen Meridian* shews you the latitude of places, and their difference of latitude, either N. or S. from the *Equator*: for the latitude of a place is the same as the elevation of the pole above the *Horizon*. That is, whatever figure, or number, the *Horizon* cuts the *Meridian* in, so many degrees is the pole elevated, which is the latitude, as you will more plainly see, when we come to speak of latitude and longitude.

4. *Of the* HORIZON.

Tyro. What is the *Horizon*?

Philo. The *Horizon* is that great circle which divides the heavens and earth into two equal parts, one called the upper, and the

the other the lower *Hemisphere*. There are two sorts, the one called the *sensible*, or *natural*, the other the *rational*, or *mathe-matical Horizon*.

Tyro. What is the *sensible Horizon*?

Philo. The *sensible Horizon* is that which divides the visible part of the heavens from the invisible; and is that great circle which we see all round us (standing upon any hill, or at sea) and seems as if the heavens and earth coincided, or joined together.

Tyro. What is the *rational Horizon*?

Philo. The *rational*, or *real Horizon*, is that which passes through the center of the earth, and divides it (as was said before) into the upper and lower *Hemisphere*.

☞ This *rational Horizon* is represented by that broad *wooden circle*, lying with its face upwards, having two notches cut in it, one on the N. and the other in the S. part, in which the *Brazen Meridian* is slipt, or moved up and down, with pleasure: the poles of the *Horizon* are the *Zenith* and *Nadir*.

Tyro.

Tyro. Please to give me a further description of the *Horizon*?

Philo. There are 4 circles on the face of the wooden *Horizon*; viz.

1. The inner circle, or that circle at the inward edge next the globe, is divided into 12 equal parts, or signs, answering to the 12 signs in the *Ecliptic*, with their names likewise prefixed to them. As to this sign γ , is wrote *Aries*, this δ , is wrote *Taurus*, &c. of the rest.

Note. *Aries* γ is in the E. *Libra* π in the W. *Cancer* ϕ in the N. and *Capricorn* ψ in the S. point of the *Horizon*.

2. Next to these signs is a *Calendar* of months, according to the *Julian* account, or *Old Stile* (used in *England* till the year 1752;) so that inward circle being divided into degrees, answers the days of the month; for right against the day is the degree of each sign the sun enters in on any day: or, *vice versa*, right against the sign, or degree, is the day of the month answering thereto.

3. Next to this is another *Calendar* according to the *Gregorian* account (done by pope *Gregory XIII.* in the year 1582)

E

called


78 *Description of the GLOBES.*

called the *New Stile*, which is 11 days sooner, or before the *Old Stile*, as you may see by the position of the *Calenders*, the 10th of *March* in the first, or *Old Calender*, being right against the 21st in the *New*, or *Gregorian Calender*. This *New Stile* is now used by us in *England*, as well as in foreign nations, pursuant to an act of parliament in 1751 *.

Lastly. On the outward verge off the *Horizon* is the circle of the *Winds*, or *Rhumbs*; viz. the *Mariner's compass* being 32 in number (beginning at the N.) each *Point*, or *Rhumb*, contains $11\frac{1}{4}$ degrees; for 32 multiplied by $11\frac{1}{4}$ makes 360.

Tyro. Sir, I thank you kindly. Pray tell me now the use of the *Horizon*?

Philo.

*  *Note.* Though this description of the *Horizon* answers most globes, yet you are to observe, that on *Senex's* globes (and I suppose others) made since the alteration of the stile, 1752, the *New Stile* is put upon the inner circle next the signs on the *Horizon*, and the *Old Stile* is outward. But this can be no difficulty; for it is very easy to be seen which is the *New*, and which is the *Old Calender* on any globes; the *New* being 11 days before the *Old*, so that one being known, the other will easily be known also.

Philo. The *Horizon* shews the *rising* and *setting* of the sun, length of days and nights: also the *rising* and *setting* of the stars in any latitude; together with the *Azimuth*, *Amplitude*, *Almicanter*, &c. of the sun, or any star, and the point they rise or set upon, &c.

5. Of the COLURES.

Tyro. Pray what are the *Colures*?

Philo. The *Colures* are two great circles, cutting the *Equator* at right angles, and pass through the pole of the world.

The *Solstitial Colure* is that great circle which passes through *Cancer* and *Capricorn*, shewing *Winter* and *Summer*.

The *Equinoctial Colure* passes through *Aries* and *Libra*, and shew the *Spring* and *Autumn*.

And, now, having given you a full description of the principal circles; I propose to describe the *lesser*, and shew you more of the nature of the globe, and the appendants belonging.



D I A L O G U E VI.

*Concerning the lesser circles of the Sphere,
commonly called parallel circles.*

S E C T. I.

Tyro. **W**HAT do you mean by the
lesser, or parallel circles?

Philo. All such circles as do not divide,
or cut the globe into two equal parts; but
that cut off any segment, or part, less than
the half, are *lesser circles*.

Tyro. Why are they called *parallel*
circles?

Philo. Because they are *parallel* every
where to the *Equator* *.

Tyro. Pray tell me the names of the
lesser circles?

Philo.

* In the *Latitude, or Parallel of London*, a degree
contains about 37 miles on the *Equator*.

Philo. They are the *Tropics* and *Polar Circles*.

1. *Of the TROPICS.*

Tyro. Pray which are the *Tropic Circles*?

Philo. Look for the sign *Cancer* on the globe, and you will find a circle drawn with a double line from thence round the *Globe*, parallel to the *Equator*, which is called the *North Tropic*, or *Tropic of Cancer*, being $23\frac{1}{2}$ degrees from the *Equator* northward, shewing the sun's greatest northern declination. Then looking for the sign *Capricorn*, you will find the same sort of circle, which is called the *Southern Tropic*, being also $23\frac{1}{2}$ degrees from the *Equator*, and shews the sun's greatest southern declination, or variation from the *Equinoctial*.

2. *Of the POLAR CIRCLES.*

Tyro. Which are the *Polar Circles*?

Philo. They are two small circles, lying near the poles (*viz.* $23\frac{1}{2}$ degrees distance)

82 *Description of the GLOBES.*

distance) drawn also with double lines: that on the N. is called the *Arctic Circle*, and that on the S. the *Antarctic Circle*. These circles are the poles of the *Ecliptic*.

Tyro. Pray what is their use, or what do we learn from them?

Philo. All those inhabitants that live under these lines have their longest day just 24 hours long, and their longest night the same (save the benefit of twilight, which is but trifling.) If you go further to the poles, their days are 2, 3, and 4 days, or 2, 3, 4, or 6 months long, as you will find demonstrated in the problems.

Tyro. Surprizing! I long to see those places, having heard of such things, but always looked upon them as idle tales.

Philo. You may depend upon the truth of it, and will soon see the reason. But, now, we will shew you the *Appendants* belonging to the globes.

S E C T.

S E C T. II.

Of the Appendants belonging to the Globes.

Tyro. **W**HAT do you mean by *Appendants*?

Philo. *Appendants* are in some respects the same as *Appurtenances*, being such necessary things, both moveable and immoveable, as belong to globes; the principal, or chief of which, are as follows.

I. *Of the Hour Circle, or Index.*

Tyro. Pray what is *Hour Circle* and its use?

Philo. The *Hour Circle*, called also the *Horary Circle*, or *Dial Plate*, is a small circle of brass, divided into 24 hours; the upper 12 represents noon, and the lower 12 midnight. It is skrewed on the meridian round the N. pole, and on the pole itself is placed the *Index*, or *Hand*, which turns round with the globe.

Its use is to tell the time of the rising and setting of the sun, or stars, in any

84 *Description of the GLOBES.*

latitude ; and what o'clock it is in any part of the world, &c.

2. *Of the Quadrant of Altitude.*

Tyro. Pray, what is the *Quadrant* of *Altitude* ?

Philo. This is a thin piece of pliable brass, divided into 90 degrees, answering the degrees of the *Equator*, beginning at the lower end with (0) to 10, 20, 30, &c. to 90. At which figure it has a nut, which slips upon the meridian at pleasure, and is fastened thereto by a skrew.

Tyro. Pray, what is the chief use of this *Appendant* ?

Philo. Its use is to tell the height of the sun, or stars, at any hour, and when they are due E. and W. Also the distance of the stars from one another, and the distance of one place from another on the terrestrial globe, &c. &c. &c.

3. Of the Semi-circle.

Tyro. What is the *Semi-circle* of position?

Philo. It is a thin piece of brass, divided into 180 degrees, answering one half of the *Equator*. It may be called a double *Quadrant* of *Altitude*, but is used only in some particular problems, the *Quadrant*, or *Horizon*, supplying its place.

4. Of the Nautical Box, or Mariner's Compass.

Tyro. What is the *Nautical Box*, and its use?

Philo. This is an instrument used in navigation, having the 32 points of the wind marked, or drawn, on a *Card*, or *Sea Chart*, and an index being touched with the load-stone points always northward. This *Card*, or *Chart*, is hung in an *Horizontal Plane*, and fixed on any part of the *Horizon* of the globe, or elsewhere,

where, to shew what point of the compass you are sailing upon, or are in.

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S E C T. III.

Concerning the different names of the Sphere, according to its different position, or situation.

Tyro. **W**HAT do you mean by the Sphere's having different names according to its position? I do not understand you.

Philo. Observe then. There are 3 sorts of Spheres; viz. *a Parallel, a Right, and an Oblique Sphere.*

1. *A Parallel Sphere.*

A Parallel Sphere has this position.

1. The poles are in the *Zenith* and *Nadir*; that is, one pole is right up, and the other right underneath. 2. The *Equator* will be in the *Horizon*.

The

The Property of this Sphere.

The inhabitants of this *Sphere* are those that live under the poles, and have the longest days and nights of any other inhabitants; their shortest day being 24 hours long, and their longest 6 months*.

2. *A right Sphere.*

A right Sphere has this position.

1. The poles will lie, or be in the *Horizon*. 2. The *Equator* will be in the *Zenith* and *Nadir*. 3. The *Equator* and all the lesser circles will cut the *Horizon* at right angles; viz. perpendicularly.

The Property of this Sphere.

The inhabitants of this *Sphere* are those who live under the *Equinoctial Line*, or *Equator*, and have their days and nights always equal; viz. 12 hours each.

E 6

3. *An*

* See p. 95, 96, under the definition of climates.

3. *An Oblique Sphere.*

An *Oblique Sphere* is that position of the globe, that has the 3 following properties; viz. 1. One pole is as much above the *Horizon* as the other is underneath. 2. The *Equator* is part above, and part under the *Horizon*. 3. The *Equator* and all the parallel circles cut the *Horizon* obliquely.

The Property of this Sphere.

The inhabitants of this *Sphere* are those that live in all other parts, except under the *Poles* and *Equinoctial Line*.



S E C T. IV.

Of the different names of the inhabitants of the Globe, in respect of their situation.

Tyro. **Y**OU have already told me the three different positions of the *Sphere*;

Sphere; pray what do you mean by the names of the several inhabitants?

Philo. Without any consideration of the different position of the *Sphere*, these inhabitants have different names, according to the several meridians and parallels they lie under.

Tyro. Please to tell me their different names?

Philo. There are 6 different inhabitants; 1. *Antæci.* 2. *Periæci.* 3. *Antipodes.* 4. *Amphiscii.* 5. *Periscii.* And 6. *Heterocii.*

I. *Of the ANTÆCI.*

The *Antæci*, or *Antæcians*, are those inhabitants that have the same longitude, that is, lie under the same meridian, having as many degrees latitude S. as we have N.

Their Property.

1. Their hour is the same as ours, it being noon, &c. with both at the same time.
2. Their days are equal to our nights,

Description of the GLOBES.

nights, and *vice versa*. And 3. Their summer is our winter.

2. *Of the PERIÆCI.*

The *Periæcians* are those that lie under the same parallel of latitude, on the same side of the *Equator*, only are distant 180 degrees of longitude; *viz.* a semi-circle.

Their Property.

1. They have contrary hours, being noon with them when it is midnight with us. 2. Their days and nights are of the same length of ours. 3. Their season, or time of the year, is also the same with us.

3. *Of the ANTIPODES.*

The *Antipodes* are such inhabitants as have the same latitude S. as we have N. but differ 180 degrees in longitude. That is, they have opposite parallels, and opposite meridians.

Their

Their Property.

These inhabitants, are (as it were) compounded with the former. For, 1. Their hour is contrary, being noon with one when it is midnight with the other. 2. The longest day of the one is the shortest day, or longest night to the other. And 3. The 4 seasons are contrary, their summer being our winter, &c. &c.

Tyro. It is wonderful indeed! I have often heard, it is true, that there are such persons as walk feet to our feet (that is, go with their heads downwards in respect of us:) pray are not the *Antipodes* this sort of people?

Philo. They are, and however strange it may seem, it is very truth itself; and this you will easily see, when you come to the problems, if you will but bear a little patience.

Tyro. Sir, I am obliged to you, and will be content till then. Please now to tell me concerning the other three inhabitants.

Philo.

Philo. They have their names from the different positions of their shadows.

4. *Of the AMPHISCII.*

They are so called, because their shadows are cast different ways at different times of the year; that is, their shadow is *Southward* from *March* to *September*; and *Northward* from *September* to *March*. Therefore, it is easy to perceive that these are inhabitants living in the *Torrid Zones*, that is, between the *Equator* and the two *Tropics*.

5. *Of the PERISCHII.*

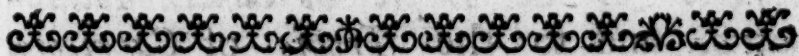
These are so called because they have their shadows go quite round them. Such, therefore, are the inhabitants that dwell between the *Polar Circles* and the *Poles*, that is, from $66\frac{1}{2}$ degrees of latitude, to 90.

6. *Of*

6. *Of the HETEROSCHII.*

They are so called, as having their shadow cast but one way, that is, either always towards the N. or always towards the S.

These then are such as live in the *Temperate Zones*; that is, between the *Tropics* and the *Polar Circles*. Those in the *South Temperate Zone* have their shadow cast always *Southward*; and those in the *North Temperate Zone* have their shadows always cast *Northward*, as in *England*, *France*, *Spain*, and almost all *Europe*.



S E C T. V.

Of the ZONES, or CLIMATES.

I. *Of the ZONES.*

Tyro. **W**HAT do you mean by the
Zones?

Philo.

Philo. A *Zone*, or *Girdle*, is a tract, or space, that surrounds the surface of the earth, as a *Belt*, or *Girdle*, does the body.

Tyro. How many *Zones* are there?

Philo. Three; viz. 1. *Torrid*. 2. *Temperate*. And 3. *Frigid Zones*.

Tyro. You gave me an account of their different situation in the last section; be pleased, now, to tell me their extent, that I may have a better idea of the division of the globe?

Philo. You remember that I told you from the *Equator* to either pole is 90 degrees; therefore, from the N. to the S. Pole is 180 degrees. Observe then,

1. The *Torrid Zone* extends from the *Equator* to the *Tropic of Cancer* Northward, and to the *Tropic of Capricorn* Southward $23\frac{1}{2}$ degrees each; (very nearly) viz. 47 degrees in all.

2. The *Temperate Zones* extend themselves from the two *Tropics* to the *Polar Circles* on both sides the *Equator*; viz. 43 degrees each, being together 86 degrees.

3. The *Frigid Zones* extend from the *Polar Circles* to the *Poles*, being each $23\frac{1}{2}$ degrees;

$\frac{1}{2}$ degrees; viz. 47 in breadth; so that $23\frac{1}{2}$, 43, and $23\frac{1}{2}$, make 90 degrees; the distance from the *Equator* to either *Pole*. Or rather thus, the *Torrid Zones* contain 47 degrees, the *Temperate* 86, and the *Frigid* 47, in all 180 degrees.

Tyro. Sir, I thank you for this explanation, it is very plain to be understood: please, now, to tell me what you mean by the climates?

2. Of the CLIMATES.

Philo. *Climates* are tracts, or circles, upon the surface of the globe, of such a certain breadth from the *Equator* to either *Pole*, that the length of the *artificial* day (viz. from the sun rise to sun set) is just half an hour longer than in the next *Climate* nearer the *Equator*, till you come to the *Polar Circles*, and then, indeed, the day differs in each *Climate* one entire month.

Tyro. How many *Climates* * are there that differ by the half hour, and how many by the entire month?

Philo.

* *England* and part of *Scotland* is in the 19th *Climate*; viz. from about $51\frac{1}{2}$, to $54\frac{1}{2}$ degrees latitude, that is, near

Philo. There are 60 *Climates* in all ; viz. 30 on each side of the *Equator*, called accordingly *North* and *South* : of these 60, 48 of them extend from the *Equator* to the *Polar Circles*, and each differ by half hours. And the remaining 12 are contained between the *Polar Circles* and the *Poles*, each differing one entire month from the other *.



D I A L O G U E VII.

An explanation of the most useful terms used in Geography and Astronomy.

S E C T. I.

Tyro. **Y**OU have, Sir, given me a very plain and satisfactory account of the nature and properties of the globe :
I will

near 3 degrees extent. For the extent of all the *Climates*, see *Gordon's Grammar*. DEF. 17.

* See page 87.

I will now trouble you to explain the terms to me; for what can I do, till I know the signification of such words as are used in the science?

Philo. It is very true, and I will explain them as well as I am able; and, pray, be careful to get them by heart, though not just in the very words I tell you, yet so as to know the meaning of them, and the practical part will then easily follow; for the want of this is the chief occasion that most learners are so deficient in what they undertake.

Tyro. You may depend upon my care.

Philo. Very well; I am satisfied, in hopes of your keeping your promise.

Explanation of the Terms, &c.

1. *Zenith*, is that point of the heavens that is right over head.

2. *Nadir*, is that point right under feet, being directly, or diametrically, opposite to the *Zenith*.

3. *Zenith Distance*, is the number of degrees that the sun, or any star, wants
of

98 *Description of the GLOBES.*

of 90 degrees, when they are upon the meridian, or greatest height.

4. *Altitude*, is height. *Meridian Altitude* is the greatest *Altitude*, or height, at 12 o'Clock.

5. *Declination*, is the distance of the sun, or any star, from the *Equator*, or *Equinoctial*, counted on the *Brazen Meridian* in degrees, and is called *North*, or *South*, according to which side of the *Equinoctial*, the *Declination* is.

6. *Right Ascension*, is an *Arch* of the *Equinoctial*, contained between the sign *Aries* γ , and the degree of the *Equinoctial*, that is cut by the *Brazen Meridian*, when the sun, or star, is brought to the *Meridian*.

7. *Oblique Ascension*, is that *Arch*, or *Degree* of the *Equinoctial*, contained between the sign γ , and the degree of the *Equinoctial*, which is cut by the *Horizon* at the rising of the *Sun*, or *Star*.

8. *Oblique Descension*, is just the reverse, being the *Degree* of the *Equinoctial*, cut by the *Horizon* at the setting of the sun, or star.

9. *Ascen-*

9. *Ascensional Difference*, is the difference of degrees between the *right* and *oblique Ascension*, which converted into time, by allowing 15 degrees for every hour, shews how much the sun, or star, rises, or sets, before, or after fix. That is, subtract the *Oblique* from the *right Ascension*, tells the *ascensional* difference.

10. *Amplitude*, is an *Arch* of the *Horizon*, contained between the true E. and W. point, at the rising and setting of the sun, or stars, counted in degrees from the E. and W. points of the *Horizon* where they rise and set, and is called *North*, or *South Amplitude*, accordingly.

11. *Azimuth*, is in effect the same as *Amplitude*, save only with this difference; that whereas *Amplitude* is only at rising and setting, *Azimuth* shews the distance from the E. and W. points, at any time, when the sun, or stars, are above the *Horizon* *.

12. *Ele-*

* *Note*, *Azimuth* is not expressed alike in all authors. Some call it always *North*, or *South Azimuth*, and reckon the *Azimuth* from these two points eastward, or westward. Others reckon it from the E. and W. points, either

98 *Description of the GLOBES.*

of 90 degrees, when they are upon the meridian, or greatest height.

4. *Altitude*, is height. *Meridian Altitude* is the greatest *Altitude*, or height, at 12 o'Clock.

5. *Declination*, is the distance of the sun, or any star, from the *Equator*, or *Equinoctial*, counted on the *Brazen Meridian* in degrees, and is called *North*, or *South*, according to which side of the *Equinoctial*, the *Declination* is.

6. *Right Ascension*, is an *Arch* of the *Equinoctial*, contained between the sign *Aries* γ , and the degree of the *Equinoctial*, that is cut by the *Brazen Meridian*, when the sun, or star, is brought to the *Meridian*.

7. *Oblique Ascension*, is that *Arch*, or *Degree* of the *Equinoctial*, contained between the sign γ , and the degree of the *Equinoctial*, which is cut by the *Horizon* at the rising of the *Sun*, or *Star*.

8. *Oblique Descension*, is just the reverse, being the *Degree* of the *Equinoctial*, cut by the *Horizon* at the setting of the sun, or star.

9. *Ascen-*

9. *Ascensional Difference*, is the difference of degrees between the *right* and *oblique Ascension*, which converted into time, by allowing 15 degrees for every hour, shews how much the sun, or star, rises, or sets, before, or after fix. That is, subtract the *Oblique* from the *right Ascension*, tells the *ascensional* difference.

10. *Amplitude*, is an *Arch* of the *Horizon*, contained between the true E. and W. point, at the rising and setting of the sun, or stars, counted in degrees from the E. and W. points of the *Horizon* where they rise and set, and is called *North*, or *South Amplitude*, accordingly.

11. *Azimuth*, is in effect the same as *Amplitude*, save only with this difference; that whereas *Amplitude* is only at rising and setting, *Azimuth* shews the distance from the E. and W. points, at any time, when the sun, or stars, are above the *Horizon* *.

12. *Ele-*

* *Note*, *Azimuth* is not expressed alike in all authors. Some call it always *North*, or *South Azimuth*, and reckon the *Azimuth* from these two points eastward, or westward. Others reckon it from the E. and W. points, either

12. *Elevation* of the pole, is the same as *Latitude*. There are three sorts; viz.

1. *Latitude* of a place, is its distance from the *Equator*, either *North* or *South*, numbered in degrees on the *Brazen Meridian*: or in other words, it is the *Elevation* of the pole above the *Horizon*.

2. *Latitude* (in *Navigation*) is the distance of a ship from the *Equinoctial*, counted on the *Meridian*. So that if a ship sails towards the *Equinoctial*, she is said to depress the pole; and, if she sails from the *Equinoctial*, she is said to raise the pole.

3. *Latitude* of a star, is its distance from the *Eliptic*, being an *Arch* of a circle of longitude, reckoned from the *Ecliptic* towards its pole, either N. or S.

13. *Longitude* is also of three sorts; viz.

1. *Longitude* of a place, is an *Arch* of the *Equator*, intercepted between the first

either northward, or southward, which, I think, is best, they being the two points that *Azimuth* is nearest to in our, or any lesser latitude, at any hour: however, it matters not which, if you mind this one rule; suppose I say, the sun has 60 degrees *Azimuth* from the N. eastward, it is the same as if I say he has 30 degrees *Azimuth* from the E. northward. See PROBLEM XXI.

first *Meridian* (or point *Aries* Υ) on the *Equator* and the *Meridian* of the place*.

2. *Longitude* of a star, is an *Arch* of the *Ecliptic*, counted from the beginning of *Aries*, to the place where the star's circle of longitude crosses the *Ecliptic*; so that it may be said to be the star's place in the *Ecliptic*, counted from the point *Aries*, which cannot exceed 180 from the *Equinoctial* point.

3. *Longitude* (in *Navigation*) is an *Arch* of the *Equator*, contained between the first *Meridian* and the *Meridian* the ship is in.

F

Tyro

* *Note*, *Longitude* of places differ according from what first *Meridian* they are counted. Thus, upon some globes, *London* is 23 degrees E. longitude, on others 20, &c. and on *Senex's* globes all 18 degrees E. longitude of the first *Meridian*. For some place their first *Meridian* at *Gratiofo*, others at *Teneriff*, and *Senex* at *Ferol*. But this matters not at all; for when you know the difference (as you will soon see that by practice) you will know to work by either, and have the same answers.

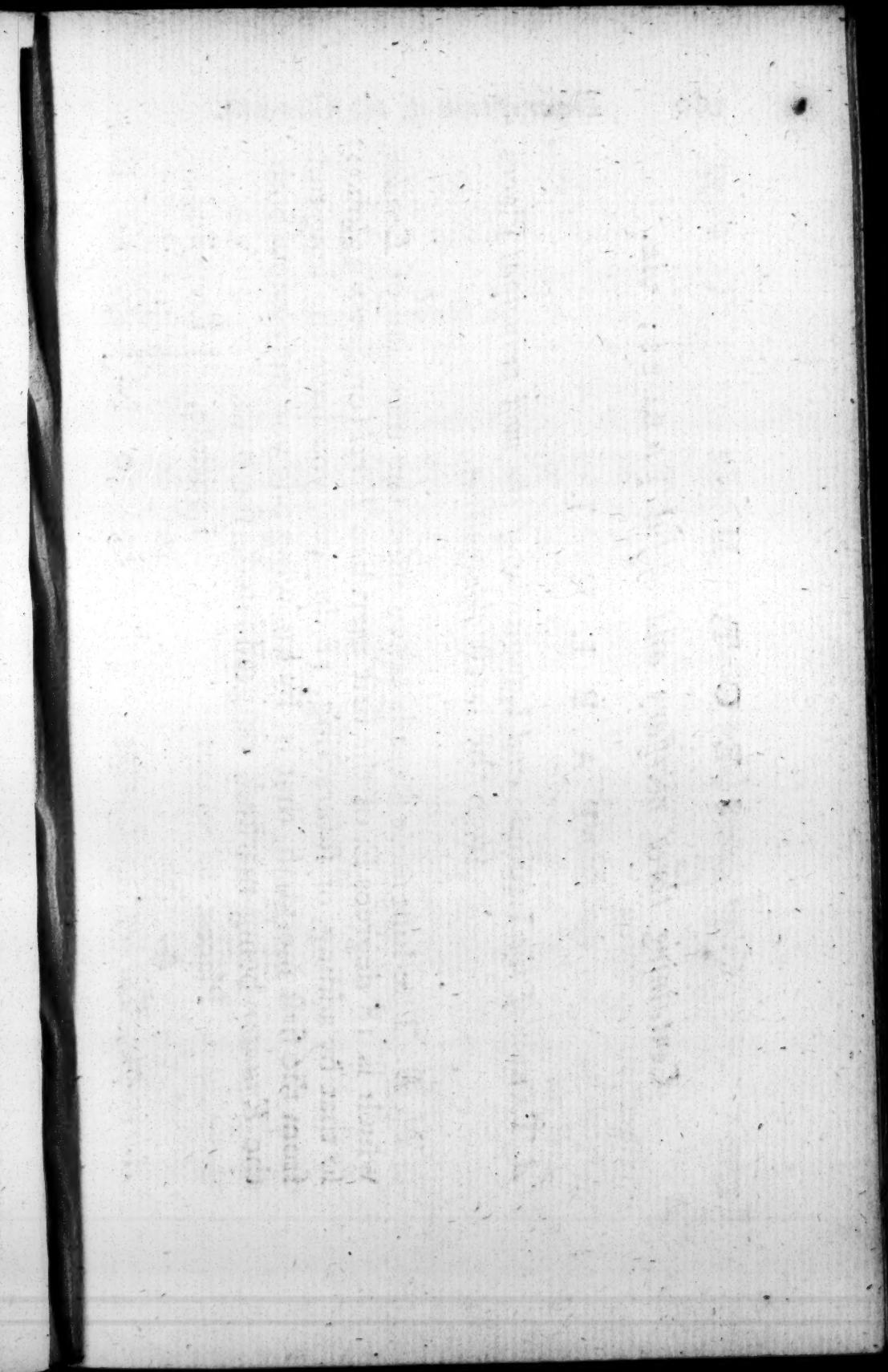
N. B. In reckoning of longitude from *London*, you will find all 18 degrees from *Aries* eastward on *Senex's* globe, a cypher (o) under the lower part of the *Equator*, under the meridian of *London*, and there begins the longitude from *London*; viz. 180 degrees eastward, and 180 degrees westward, numbered by 10, 20, 30, &c. to 180. *Note* further, That no longitude exceeds 180; for 181 E. is more properly 179 W. longitude.

Tyro. I humbly thank you, Sir ; for these definitions, which when well understood, must render the use of the globes very familiar ?

Philo. Indeed, my dear pupil, there can be nothing hard in the practical part, when once you have a tolerable notion of what I have shewn you.

But, because I would have you understand yet more, I have inserted the following tables (contrary to any other small treatise I ever saw) that you may not be at a loss, when you work some choice *Problems*, but refer both for instruction and confirmation.





S E C T. II.

Containing three necessary and useful TABLES; viz.

T A B L E I.

A TABLE of the Latitude and Longitude of the most principal Places, from the latest observation.

N. B. The longitude here is taken from the meridian of London, which is 18 degrees E. of the first meridian *Ferol* (on *Senex's* globe :) so that by adding, or subtracting, 18 degrees, you have the longitude from the first meridian, that is, by knowing one you may know both; the *Equator* being marked, or graduated, for both.

Places.	Latitude.		Longitude.	
	°	'	°	'
<i>Adrinople, Turkey, in Europe</i>	43	30	N. 27	24 E.

Description of the GLOBES.

	N.	E.	S.	W.
<i>Aix la Chapelle, in Westphalia</i>	50	48	7	00
<i>Aleppo, Syria, in Asia</i>	36	50	38	30
<i>Alexandria, Egypt, in Africa</i>	31	25	30	50
<i>Amsterdam, in Holland (and capital)</i>	52	29	5	15
<i>Archangel, in Russia</i>	64	30	42	10
B.				
<i>Babylon, in Chaldaea (called Bagdad)</i>	34	45	48	45 W.
<i>Barbadoes, in the West Indies</i>	13	14	59	50 E.
<i>Bengal, in the East Indies</i>	21	00	88	00 E.
<i>Berlin, Upper Saxony, in Germany</i>	52	10	13	40
<i>Bologne, Picardy, in France</i>	50	36	1	50 W.
<i>Boston, in New England</i>	43	10	69	30 W.
<i>Bristol, in England</i>	51	33	2	34
C.				
<i>Cadix, Andalusia, in Spain (and capital)</i>	36	30	5	45 W.

Places.	Latitude. ° /	Longitude. ° /
<i>Cairo, Egypt, in Africa</i>	36 5 N.	40 00 W.
<i>Candia, in the Island of Candia</i>	34 55	24 50 E.
<i>Canterbury, in Kent</i>	51 10	1 6
<i>Canton, in China</i>	23 12	112 52
<i>Candy, in the Island of Ceylon</i>	8 15	80 30
<i>Cape of Good Hope, S. of Africa</i>	34 45 S.	18 00
<i>Cochin China, East Indies</i>	13 00 N.	107 00
<i>Colchester, in Essex</i>	51 56	0 50
<i>Constantinople, Romania, in Turkey</i>	41 40	29 40
(and capital)		
<i>Copenhagen, Zeland, in Denmark</i>	55 40	12 35
(and capital)		
<i>Corinth, Morea, in Turkey</i>	38 00	22 25
<i>Cracow, capital of Poland</i>	50 15	20 50

Description of the GLOBES. 103

<i>Cremona, Milan, in Italy</i>	45	10	N.	10	32
<i>Cyprus Island, in the Levant</i>	35	00		34	00
D.					
<i>Dublin, capital of Ireland</i>	54	50		7	20 W.
<i>Dunkirk, Flanders</i>	51	7		2	30 E.
E.					
<i>Edinburgh, capital of Scotland</i>	55	56		3	00
<i>Ephesus, Natolia, in Asia</i>	37	50		27	35
F.					
<i>Frankfort, on the Oder, in Germany</i>	52	28		14	35
<i>Frankfort, on the Main, in Germany</i>	49	45		9	45
G.					
<i>Gibraltar, Andalusia, in Spain</i>	35	30		4	50
<i>Glasgow, in Scotland</i>	56	20		4	18

Places.	Latitude.	Longitude.
H.		
Hague, in Holland	52 10 N.	4
Hanover, Saxony, in Germany	52 16	10 0
J.		
Jerusalem, Palestine, in Asia	32 44	36 15
K.		
Koningsburgh, Prussia, in Poland	54 55	22 15
L.		
Lima, in Peru, in South America	11 30 S.	78 40 W.
Lisbon, capital of Portugal	38 45 N.	8 20
London, capital, or metropolis, of England	51 32	0 0

Description of the GLOBES.

M.	S.	E.
Madagascar, an island in Africa	19 29	43 55
Madrid, New Castile, in Spain (and capital)	40 10 N.	3 28 W.
Malta, near Sicily, in Mediterranean	39 10	4 00 E.
Moscow, capital of Muscovy	55 30	39 30
F 5		
N.		
Nankin, or Nanquin, in China	31 00	118 30
Naples, in Italy	41 45	14 50
O.		
St. Omer's, in France	50 50	2 20
P.		
Panama, North America	8 30	82 30 W.
Paris, capital of France	48 45	2 20 E.
Petersburgh		105

Places.	Latitude.	Longitude.
	° /	° /
<i>Peterburgh</i>	60 00	31 32
<i>Prague, capital of Bohemia, in Germany</i>	50 00	14 25
<i>Presburgh, in Hungary</i>	48 22	15 30
<i>Pekin, in China</i>	39 52	110 52 E.
<i>Port Royal, Jamaica</i>	18 00	77 5 W.
<i>Quebec, in Canada</i> Q.	47 10	70 15 E.
<i>Rhodes Island, Archipelago</i> R.	35 30	29 15
<i>Rome, capital of Italy</i>	42 8	13 7
<i>Siam, in the East-Indies</i> S.	14 5	100 50

Description of the GLOBES.

107

	49	0	N.	8	10
<i>Spire, Upper Rhine, Germany</i>	59	30		19	5
<i>Stockholm, capital of Sweden</i>	35	15		15	0
<i>Syracuse, Sicily</i>					
<i>T.</i>					
<i>Tangier, Barbary, in Africa</i>	35	45		6	00 W.
<i>Thyatira, Natolia, Asia</i>	38	28		28	32
<i>Tripoli, Barbary, Africa</i>	33	55		13	50
<i>Tunis, ditto</i>	35	30		12	40
<i>W.</i>					
<i>Warsaw, in Poland</i>	52	10		22	00
<i>Y.</i>					
<i>York, in England</i>	52	20	0	1	8 W.

TABLE

TABLE II.

Shewing the sun's place, declination, time of rising and setting; length of days, and beginning and ending of twilight, one day in every month, for the latitude of London, according to the New Stile, 1752.

N. B. (°) stands for degrees (′) for minutes, H for hours
M. for minutes, ☉ for the sun, D. for declination,
N. for North, S. for South.

Months.	☉'s Place	Declin	☉'s Rif. and Sett	L. of Days.	Twilight b-g. ends.
	° ′	° ′	H M H	H. M.	H. M H.
Jan. 20	♊ 1. 45	19. 51 S.	7. 48. 5	8. 24	5. 43 7
Feb. 19	♋ 1. 55	10. 31 S.	6. 55. 6	10. 10	5. 00 7
Mar. 22	♌ 2. 50	1. 4 N.	5. 56. 7	12. 8	4. 00 8
Apr. 22	♍ 2. 14	12. 13 N.	4. 48. 8	14. 24	2. 38 10
May 22	♎ 1. 11	20. 25 N.	4. 8. 8	15. 44	12. 30 12
June 22	♏ 1. 0	23. 29 N.	4. 42. 8	6. 36	No Night till June the 20th. 42 12
July 21	♐ 28. 30	20. 24 N.	4. 7. 8	15. 46	
Aug. 20	♑ 27. 17	12. 29 N.	4. 53. 8	14. 14	2. 21 10
Sept. 19	♒ 26. 27	1. 29 N.	5. 51. 7	12. 14	4. 00 8
Oct. 19	♓ 26. 6	10. 1 S.	6. 50. 6	10. 20	5. 00 7
Nov. 18	♐ 26. 14	19. 18 S.	7. 43. 5	8. 34	5. 45 7
Dec. 22	♑ 1. 45	23. 19 S.	8. 12. 4	7. 36	5. 58 7

TABLE

T A B L E III.

A TABLE of the right Ascension, Declination, Latitude, and Longitude, of some of the most eminent fixed Stars, taken from Senex's celestial Globe, 1754, for the use of the learner.

Description of the GLOBES.

109

Names and Constellations.	R.A. ° ' "	Declin. ° ' "	Lat. ° ' "	Long. ° ' "	
Aldebaran, in Taurus	65 15	16 15 N.	4 45 N.	6 00	II
Alioth, in Ursa Major	189 30	57 30	54 00	6	III
Alcair, in Aquila	293 45	8 30	29 30	28	IV
Albiero, in Cygnus	289 45	27 30	55 00	19	V
Aridef, in ditto	307 45	44 30	59 30	3 30	VI
Acharnar, in Eridanus	23 30	59 30 S.	60 0 S.	13 00	VII
Alfeta, in Corona	230 45	27 15 N.	40 30 N.	8 00	III
Arcturus, in Bootes	210 45	20 30	30 30	23 00	III

Asengue,

Names and Constellations.	R. A. ° ' "	Declin. ° ' "	Lat. ° ' "	Long. ° ' "	
<i>Asengue</i> , in <i>Lyra</i>	277 00	38 30 N.	61 30	11 00	♊
<i>Bellatrix</i> , in <i>Orion</i>	77 30	6 15	15 45	17 00	♊
<i>Betelgeuze</i> , in ditto	84 30	7 30	24 30	16 15	
<i>Benenaex</i> , in <i>Ursa Major</i>	204 15	50 30	74 30	23 00	♊
<i>Canobus</i> , in <i>Argo-Navis</i>	95 30	53 0	76 00	10 00	♊
<i>Castor</i> , in <i>Gemini</i>	109 80	32 30 N.	9 45 S.	16 00	♊
<i>Castor's brother</i> , <i>Pollux</i> , ditto	111 45	28 30	7 00 N.	19 30	
<i>Capella</i>	73 00	45 45	23 00	17 00	♊
<i>Cor Hydra</i> , <i>Hydra's Heart</i>	138 30	8 15	22 30	24 00	♊
<i>Cor Scorpio</i> , <i>Scorpio's Heart</i>	243 00	26 00	4 45	5 45	♊
<i>Cor Leo</i> , called <i>Regulus</i>	148 00	13 00	0 45	26 00	♊
<i>Deneb</i> , in <i>Leo Major</i>	173 45	16 30	12 30	18 00	
<i>Dubbee</i> , in <i>Ursa Major</i>	175 00	55 30	47 30	27 30	
<i>Enif</i> , in <i>Pegasus</i>	322 15	8 45	22 30	28 00	♊

Description of the GLOVES. III

	⋈	♌	♍	♎	♏	⋈	♍	♎	♏	♐
341	31	0	21	00	30	00	30	00	30	00
342	13	30	19	00	20	00	20	00	20	00
41	3	15	12	00	10	00	10	00	10	00
111	6	00	15	00	22	00	22	00	22	00
216	59	30	42	30	26	00	26	00	26	00
75	9	15	31	00	12	30	12	30	12	30
79	1	00	23	00	17	30	17	30	17	30
80	2	00	24	00	18	30	18	30	18	30
81	3	00	25	30	19	30	19	30	19	30
342	26	15	31	00	26	00	26	00	26	00
5	55	15	46	30	3	80	3	80	3	80
98	16	30	39	15	12	00	12	00	12	00
198	9	45	2	00	20	00	20	00	20	00
161	63	30	50	00	12	00	12	00	12	00
161	58	00	46	00	16	00	16	00	16	00
192	12	30	16	00	5	30	5	30	5	30

Fomabant
 Marbal, in Pegassus
 Mencar, in Cetus
 Procyon, in Canicula
 Pes Centaurus
 Regel, in Orion's Foot
 1. Star, in the Girdle of Orion
 2. — ditto
 3. — ditto
 Scheat, in Pegassus
 Sheder, in Castiopea
 Sirius, in Canis Major
 Spica, in Virgo
 Upper Pointer, in Ursa Major
 Lower Pointer, ditto
 Vindemiatrix, in Virgo



D I A L O G U E VIII.

Containing some useful and necessary Problems on the Terrestrial Globe.

N. B. (°) stands for degrees (') for minutes.

S E C T. I.

Philo. **Y**OU say, *Tyro*, that you understand what I have shewn you concerning the definition of the globes and the appendants that belong to them; and, if so, you are fit for the following problems: but, if you think you are not perfect, or do not rightly understand what *right Ascension*, *oblique Ascension*, *Azimuth*, *Almicanters*, &c. signify, or do not know what the greater, or lesser, circles are, and the particular uses of the *Meridian*, *Horizon*, *Colures*, *Quadrant of Altitude*, &c. then, pray, turn back and read.

read them over once more, for you will find that your understanding of these things will be a great help to you.

Tyro. I thank you for your care ; but I understand them in general very well.

Philo. Then I will directly proceed to



P R O B. I:

*The latitude being given to rectify the Globe
for that place.*

DEFINITION.

I Have already told you that the latitude of any place is the very same thing as the elevation of the pole above the *Horizon* ; therefore, whatever the latitude be, suppose *London* $51^{\circ} 32'$ N. or *Madrid* $40^{\circ} 10'$ N. proceed thus,

Turn the pole on which the dial-plate is fixed towards the verge of the *Horizon*, slipping, or moving, the whole globe backwards, or forwards, in the notches of the *Horizon*, till the *Horizon* cuts
the

the *Brazen Meridian*, in $51^{\circ} 32'$ (*viz.* a little more then $51 \frac{1}{2}$) so is the globe rectified for the latitude of *London*; that is, the N. pole will then be elevated $51^{\circ} 32'$ above the *Horizon*; and *London* being brought to the meridian itself will then be in *Zenith*, or right up, and at equal distance from all parts of the *Horizon*.

Depress the pole till the *Horizon* cuts the *Brazen Meridian* at $40^{\circ} 10'$, and you have then the position of the inhabitants at *Madrid*, and turning the globe, till *Madrid* come to the meridian, you will find it in the *Zenith*, or top of the globe, under $40^{\circ} 10'$.

Note. If it were required to rectify the globe for S. latitude, then you must elevate the S. pole to the given latitude instead of the N. pole; but this is better explained by the next problem.

P R O B. II.

The latitude and longitude of any place given, to find the same.

First, **Y**OU are to observe whether the longitude be reckoned from *London*, or from the first meridian; for on some globes the first meridian begins 23° , on others 20° , and on *Senex's* globes, 18° W. of *London*; but, if once you know where the first meridian is on the globe, it is very easy to know the difference from the meridian of *London*. As for *English* authors in general, the tables of longitude are counted from the meridian of *London*, and I herein follow the same.

See a farther account of longitude
DIALOGUE VII. *Señt. I. Defn. XIII.*

E X A M P L E.

There are two certain places, one has 18° N. latitude, and $77^{\circ} 5'$ W. longitude. The other is $33^{\circ} 45'$ S. latitude,
and

and 18° E. longitude from *London*; I demand what places these are.

R U L E.

For the first place, I elevate to the N. pole 18° , because it is 18° N. latitude. Then I turn the globe to the right-hand, or eastward (because the place lies westward) till $77^{\circ} 5'$ upon the equator, counted from the meridian of *London* (which on *Senex's* globe has a cypher thus (o) on the equator) passes through, or under, the meridian: or, in other words, I turn the globe, till $77^{\circ} 5'$ westward is brought under the meridian, and here I fix the globe with a quill thrust in betwixt the globe and the *Horizon*: then I look under the latitude 18° (which is in the *Zenith*) on the meridian a-top of the globe, and under 18° on the meridian, I find *Port Royal* in *Jamaica*, the place required,

For the second place, I elevate the S. pole (though there is no occasion to elevate the pole barely to find a place; but it is better, because you have then the real.

real situation of the inhabitants) to the given latitude $34^{\circ} 45'$, and then turn the globe till 18° E. longitude of *London* come under the meridian. Then I look under the latitude $34^{\circ} 45'$ on the meridian, and just under this I find the *Cape of Good Hope*, the place required.

Again, There are 3 places. The first $32^{\circ} 55'$ N. latitude, and $35^{\circ} 15'$ E. longitude. The other is $39^{\circ} 50'$ N. latitude, and $110^{\circ} 52'$ E. longitude: and the last is $7^{\circ} 30'$ N. latitude, and $80^{\circ} 30'$ E. longitude, I demand the places.

Answer, *Jerusalem*, *Pekin*, and *Candea*, or *Candy*.



P R O B. II.

The latitude of any place given, to tell all those places that have the same latitude.

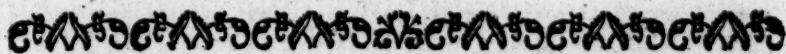
D E F I N I T I O N.

AL L those places that have the same latitude, have the days and nights of the same length, at the same time; but

but not the very same hour of the day.
See *Sect. IV. Defin. II.*

R U L E.

Bring the given place, or places, to the meridian (suppose *London* $51^{\circ} 32'$, and *Madrid* $40^{\circ} 10'$ N.) then turn the globe, and all those places that pass under $51^{\circ} 32'$, have the same latitude as *London*; viz. *Prague*, in *Germany*, &c. and all that pass under $40^{\circ} 10'$, have the same latitude as *Madrid*, which you will find to be *Pekin* nearly for one, and many other places nearly the same.



P R O B. IV.

To tell the difference of the latitude of places.

HERE are two variations, or rules.
First, If the latitudes be both N. or both S. then subtract the less from the greater latitude, and the remainder is the difference,

difference, or answer. Thus between *London* and *Madrid* is $12^{\circ} 32'$, the first being $52^{\circ} 32'$, and the other 40° . And between *Candy* and *Stockholm* is $52^{\circ} 30'$, for *Stockholm* is about $59^{\circ} 30'$ N. and *Candy* $7^{\circ} 30'$ N.

Secondly, If one place lie on the N. and the other on the S. side of the *Equator*; that is, if one be N. and the other S. latitude, then add them both together, and their sum is the difference of the latitude required.

Thus *Copenhagen* is $55^{\circ} 40'$ N. and the island of *Madagascar* is $19^{\circ} 30'$ S. these added together make $75^{\circ} 10'$ the difference required.



P R O B. V.

The longitude of any place given from any meridian, to tell those places having the same longitude.

THIS is done after the same manner as the other, only here the answer

answer will be on the *Equator*, as the others were on the meridian.

I would know what places have the same longitude as *London*, and the same longitude as *Moscow*.

R U L E.


Bring *London* to the meridian, then all those places on the globe (from the N. pole to the S. part of the *Horizon*) that lie under the edge of the meridian, have the same longitude as *London*. Thus *Fort Nassau*, and *Fort Mina* in *Guinea* have the same, or very nearly the same longitude as *London*.

And *Moscow* in *Muscovia* has very nearly the same longitude as *Aleppo* in *Syria*: also *Scandaroon*, *Antioch*, and *Tripoli* in *Syria* have the same longitude; viz. $37^{\circ} 30'$ from *London*.

P R O B. VI.

To tell the difference of the longitude of places. (See Prob. XXVI.)

D E F I N I T I O N.

 *Note* 1. No place can exceed, or be above, 180 d. of longitude from another place; for 181 d. E. longitude is with more propriety 179 d. W. longitude, for 181 d. taken from 360 d. there remains 179 d. which is nearer to the given place than 181 d.

R U L E.

HERE are also two variations as in *Prob. IV.* *First*, If the places lie both E. or both W. of the first meridian, or where you reckon the longitude from; *viz.* if they both be E. or both W. longitude, then subtract one from the other you have the difference.

Thus I find *Jerusalem* has $39^{\circ} 15'$ E. longitude from *London*, and *Pekin* $110^{\circ} 52'$ E. longitude; therefore, I subtract $36^{\circ} 15'$ from $110^{\circ} 52'$, and there remains

G

mains $74^{\circ} 37'$ difference of longitude E. or W. that is, *Pekin* is $74^{\circ} 37'$ E. longitude of *Jerusalem*; or *Jerusalem* is $74^{\circ} 37'$ W. longitude of *Pekin*.

Secondly, If one place be E. and the other W. longitude of the first meridian (suppose *London*, or any other meridian) then add their longitudes together, and the sum is the difference of longitude required.

E X A M P L E.

I would know the difference of the longitude between *Jerusalem* $36^{\circ} 15'$ E. of *London*, and *Port Royal* in *Jamaica* $77^{\circ} 5'$ W.

Here as one is E. and the other W. I add $36^{\circ} 15'$, and $77^{\circ} 5'$ together, and their sum makes $113^{\circ} 20'$ difference of longitude. That is, *Jerusalem* is $113^{\circ} 20'$ E. of *Port Royal*, or *Port Royal* is $113^{\circ} 20'$ W. of *Jerusalem*.

Note 2. If the difference of longitude after addition exceeds 180 d. take it out of 360 d. for that is the true longitude required. See *Note 1.*

E X A M-

E X A M P L E.

Pekin in *China* is $110^{\circ} 52'$ E. longitude, and *Port Royal* is $77^{\circ} 5'$ W. I add these sums together, and find it $187^{\circ} 57'$ difference of longitude, but, because it is more than 180° , I subtract $187^{\circ} 57'$ from 360° , and there remains $172^{\circ} 3'$, the difference required.

Tyro. Sir, I heartily thank you for this explanation, which I understand very well.



P R O B. VII.

The day of the month given, to find the sun's place in the ecliptic.

R U L E.

THE day of the month being given, look on the inner calender on the new globes, and you have the sign and

the degree of that sign that the sun is in for that day, according to the *New Stile*.

If it be upon old globes, look on the outward calender, you have the sign and the degree of the sign.

N. B. You may further observe, that the calender used throughout *Europe* is the calender for *N. S.* viz. *New Stile*, and is always known from the other; because it has the *Saints Days*, and several other things wrote upon it on the *Horizon*.


E X A M P L E.

I would know the sun's place in the ecliptic, on *May* the 21st, *N. S.* *March* the 21st, *June* the 21st, *September* the 22^d, and *December* the 21st.

I look for these days of the months in order as they stand in the new calender; viz. for *N. S.* before described, and right against the day of the month in the innermost circle on the *Horizon*, I find the sun's place among the signs.

Thus

Thus right against *May* the 21st, I find 1° of Π *Gemini*: and also on *March* the 21st, I find he enters Υ *Aries*: on *June* the 21st, he enters \textcircled{c} *Cancer*: on *September* the 22d he enters \textcircled{z} *Libra*: and on *December* the 21st he enters \textcircled{w} *Capricorn*.

 *Note*, That in every problem and operation, except *Old Stile* be mentioned, it is to be understood for *New Stile*; viz. N. S. and latitude always means N. latitude, except expressed S.



P R O B. VIII.

The sun's place given, to find the day of the Month.

R U L E.

THIS is only the reverse of the former problem: for having the sun's place given, seek it in the innermost circle among the signs; then against that degree in the calender N. S. you have the day of the month required.

G 3

EXAM-

E X A M P L E.

I would know what time of the year the sun is in 1° of Π , as also when he enters Υ , \odot , \sqcap , and ϖ ? Proceed according to the rule, and you will find the days to be *May* the 21st, *March* the 21st, *June* the 21st, *September* the 22d, and *December* the 21st.




P R O B. IX.

The latitude and day of the month given, to find the sun's place in the ecliptic, and rectify the globes for use.

R U L E.

FIND the sun's place on the *Horizon* by *Prob. VII.* and having noted what degree he is in, look upon the ecliptic on the globe, and find the same sign and degree as you did on the *Horizon*, then

then bring this degree of the ecliptic very carefully to the graduated edge of the *Brazen Meridian*, and holding the globe steady, turn the index exactly to the upper 12, which represents 12 at noon, and thus is the globe rectified for that day, and the degree of the ecliptic that lies under the *Equator*, represents the sun's place at noon, or 12 o'clock, that day.

 The *Astronomer's* day is reckoned from, or begins at, 12 o'clock; and, if you fix the quadrant of altitude to the latitude in the *Zenith*, the globe will be compleatly rectified: but more of this by and by.



P R O B. X.

To tell the declination of the sun on any day of the year.

D E F I N I T I O N.

DEclination of the sun is his variation from the *Equator*, either northward, or southward.

N. B. His greatest declination northward is 23 d. 30 m. which is on *June* the 21st, and his greatest declination southward is 23 d. 30 m. *December* the 21st: but on *March* the 21st, and *September* the 22d, when he enters ♈ and ♎, he has no declination at all, but is in the *Equator* itself; and then days and nights are equal to all the inhabitants on the globe.

R U L E.

Having found the sun's place in the ecliptic for the given day, bring it to the *Brazen Meridian*, and observe what degree of the meridian it lies under, and whether it be on the N. or on the S. side of the *Equator*, for that is the declination required, which is called N. or S. declination accordingly.

E X A M P L E.

Proceed according to the rule, you will find on *April* the 21st, the sun has 11° 30' N. declination, and on *May* the 21st, he has 20° 30' N. declination: but on *October* the 27th, he has 12° 30' S. declination, and on *January* the 30th, he has 16° S. declination nearly.

P R O B.

P R O B. XI.

*The latitude and day of the month given,
to tell the sun's meridian altitude ; viz.
his height at noon.*

R U L E.

BRING the sun's place to the meridian, and observe what degree of the meridian the sun's place is under ; for those degrees on the meridian that are intercepted, or lie between the South verge of the *Horizon*, and the degree which is over the sun's place on the meridian, counted on the meridian, is the sun's meridian altitude required.

E X A M P L E.

I would know in the latitude $51^{\circ} 30'$, on *May* the 21st, the sun's meridian altitude, as also his meridian altitude on *November* the 5th. I proceed according to the rule, and find his meridian altitude, *May* the 21st, to be 59° ; but on

G 5

November

130 *The use of the GLOBES.*

November the 5th, he has but $23^{\circ} 30'$ altitude.

Proceed thus, and you will find his meridian altitude, in the latitude of 40° , on the same days to be $70^{\circ} 30'$, and $34^{\circ} 30'$: but in the latitude of $20^{\circ} 30'$, on *May 21*, he will have 90° of altitude, or be right up that day to the inhabitants in that latitude, which shall be further explained by and by.



P R O B. XII.

The latitude of the place (suppose London) and the sun's meridian height given, to tell the day of the month supposing it were lost.

R U L E.

THIS problem is the reverse of the last; for you are only to set the globe to the latitude, then count from the S. verge of the *Horizon*, as many degrees on the meridian upwards as the given height is; and under that degree
of

of the meridian you have the sun's place in the ecliptic, which seek in the circle of signs on the *Horizon*, gives the day required.

E X A M P L E.

In the latitude of $51^{\circ} 30'$, on two certain days, I observed the sun's meridian altitude to be 59° and $23^{\circ} 30'$; I demand what days they are?

Proceed according to the rule, you will find the one is *May 21*, the other *November 5*.



P R O B. XIII.

*The latitude and day of the month given,
to tell the sun's altitude at any time.*

E X A M P L E.

ON *May* the 21st, at 9 in the morning, and at 5 in the afternoon at *London*, I would know the sun's altitude.

R U L E.

R U L E.

Rectify the globe for the latitude, and bring the sun's place (1° II) to the meridian, and the index to the upper 12 on the dial-plate; then fix the quadrant of altitude in the *Zenith*; (*viz.* the left edge of the nut must be fixed on the meridian at $51^{\circ} 30'$) then turn the globe till the index points to the hour, *viz.* 9 in the morning; this done, fix the globe by thrusting in a quill between it and the *Horizon*; lastly, turn the quadrant about, till the graduated or figured edge touch the sun's place, (*viz.* 1° II), and the degrees on the quadrant, counted from the *Horizon* upward on the quadrant, is his height at that time; *viz.* $43^{\circ} 30'$. Then turn the globe till the index points to 5 in the afternoon; and also turn the quadrant on the W. side, (without unskrewing it) till it touches the sun's place; and you have about 24° on the quadrant, his altitude at that time.

But at *North Cape* (*viz.* N. latitude 72°) at 9 in the morning *May 21*, he will be but about 32° high.

P R O B.

P R O B. XIV.

The latitude (suppose London) and the sun's altitude and day of the month given, to tell the hour.

THIS is only the reverse of the last problem, only it will have two answers; viz. the hour may be morning or afternoon.

R U L E.

Rectify the globe as before described, and turn the globe and the quadrant on the E. side, till the quadrant touches the sun's place at the given height, (which by the last, on *May 21*, at 9 in the morning, was found $43^{\circ} 30'$;) then look at the index, and it will point to the hour; turn it W. till the sun's place touch the same degrees on the quadrant on the W. side, and you will have the time in the afternoon.

EX-

E X A M P L E.

Thus on *May* the 21st, at *London*, when the sun is $43^{\circ} 30'$ high, it is either 9 in the morning, or 3 in the afternoon.

Note. When the sun's place and quadrant are on the E. side of the meridian it is morning hours; but when the sun's place is on the W. part of the meridian, or westward of it, it is afternoon.



P R O B. XV.

The latitude given, to tell the rising and setting of the sun, and length of the day and night at any time of the year.

R U L E.

RECTIFY the globe (*viz.* elevate it for the latitude, bring the sun's place to the meridian, and index to the upper 12,) then turn it till the sun's place comes
even

even with, or lies right against the inner verge on the E. side of the *Horizon*, then the index will shew you the time of the sun's rising; turn it to the W. side or verge of the horizon, and the index will shew you the setting. Or thus: having got the hour the sun rises, count how many it wants of 12; for so many hours will it set after. Thus; if the index points to 4 in the morning at rising, it will of course rise at 8 at night; if it points any day at half an hour past 4 at setting; both being four hours and a half from 12 at noon.

Note 1. If you double the time of rising, that is, double the hours it wants of 12 at the time of rising, it gives you the length of the Day from sun-rising to setting.

Note 2. If you subtract the length of the Day from sun-rising to sun-setting, from 24, the remainder shews you the length of the night, twilight included. See Prob. 25.

Proceed thus, and you will find the sun, on *May 26*, at *London*, to rise about 4 in the morning, and set at 8 at night.
Now

Now double what he wants of 12. at rising, *viz.* 8 hours, and it gives the length of that day at *London*, *viz.* 16 hours.

But at *Madrid*, on the same day he rises about $\frac{3}{4}$ past 4, sets $\frac{1}{4}$ past 7 at night. And at *Stockholm*, on the same day he rises at about $\frac{1}{4}$ past 3, and consequently the days are $17\frac{1}{2}$ hours long there.



P R O B. XVI.

To tell the length of the longest and shortest day at London, and at Stockholm, latitude N. 59° 30'.

R U L E.

YOU proceed the same in this as in the last problem, only instead of bringing 1° of Π , as before, you now work with 1° of \odot , or rather 30 of Π , for then the sun enters *Cancer* on *June 21*, or longest day.

You

You will find him, therefore, rise at *London*, *June* the 21st, at 42 m. past 3 in the morning, which wants 8 h. 18 m. of 12; this doubled gives 16 h. 36 m. for the longest day at *London*.

Then work with \mathbb{W} *Capricorn* for the shortest day; viz. bring \mathbb{W} *Capricorn* to the meridian, and the index to 12, and you will find the sun rises 18 m. past 8, which wants 3 h. 42 m. of 12; this doubled gives 8 h. 18 m. the length of the shortest day, which added to 16 h. 36 m. the longest day gives 24 h. for day and night.

Thus you see the length of the longest day in summer, is the same as the length of the longest night in winter.

Proceed now for *Stockholm* (viz. $59^{\circ} 30'$ N. latitude) after the same manner, you will find the longest day to be about $18 \frac{1}{2}$ h. and the shortest $5 \frac{1}{2}$ h. And thus, for any latitude, or place, not exceeding $66 \frac{1}{2}$ d. for there the days will be 24 h. and, if you go to a greater latitude, either N. or S. you will find them 30 h. long, 2, 3, 4, or 5 days, or 2, 3, 4, or 5 weeks,
or

or as many months, which I shall explain in a problem by itself by and by.

Tyro. This is a little surprizing indeed, and at present I must own myself a stranger to it.

Philo. I assure you it is no more strange than true, and will very plainly appear so to you, when we come to treat of it.



P R O B. XVII.

To tell the sun's right ascension.

WHAT right ascension is, see *Dial.* VII. *Seet.* I. *Article* VI.

Bring the sun's place to the *Brazen Meridian*, and note what degree of the *Equator* is cut by the meridian, for that is his right ascension required.

E X A M P L E.

I would know the sun's right ascension, on *March* the 21st, *June* the 21st, *September* the 22d, and *December* the 21st.

I find the sun's place for these different days, and bringing it to the meridian, I find the meridian cuts the *Equator* in (0) in (90) in (180) and in (270°) his right ascension required.

Note, When the sun enters γ , *March* the 21st, he has no right ascension, because it is counted from, or begins at, γ ; therefore, on *March* the 20th, he must have his greatest right ascension; viz. 359°.



P R O B. XVIII.

To find the sun's oblique ascension and descension at any time, and in any latitude.

See oblique ascension and descension, *Dial. VII. Sect. I. Article VII, VIII.*

N. B. Though the latitude is not required in finding the right ascension, because the *Equator* will be cut in the same place by the meridian, let the pole be elevated, or depressed; yet in the oblique ascension, the *Horizon* will cut the *Equator* in different degrees according to the latitude, as will appear by the work and your own consideration.

R U L E.

R U L E.

1. **R**ECTify the globe, and bring the sun's place down to the eastern verge of the *Horizon*, then observe what degree the *Horizon* cuts the *Equator* in, for that is the oblique ascension required.

2. Turn the globe till the sun's place comes to, or lies level with the western verge of the *Horizon*, and the degree of the *Equator* cut by the *Horizon*, is the oblique descension required.

Thus on *March* the 21st, *June* the 21st, *September* the 22d, and *December* the 21st; viz. when the sun enters ♈, ♉, ♊, and ♋, you will find his oblique ascension at *London*, to be (0) (56) (180) and (304.)

And on the same days his oblique descension will be (0) (123) (180) and (237 $\frac{1}{4}$.)

P R O B.

• P R O B. XIX.

The latitude and day of the month given, to tell the sun's ascensional difference; viz. how much he rises, or sets, before and after 6; and consequently, to tell the length of the days, suppose there were no index to the globe.

R U L E.

BY *Prob. XVIII.* and *XIX.* find the the sun's right, and oblique ascension; then subtract the oblique from the right ascension, or the contrary, and the remainder is the ascensional difference required; which divide by 15, the degrees of the *Equator* that pass through the meridian for 1 hour (or $7\frac{1}{2}$ for $\frac{1}{2}$ an hour) gives the answer in time that the sun rises and sets before and after 6. See an example in figures, how to convert degrees and minutes into time, *Prob. XXVI.*

E X A M-

EXAMPLE for L O N D O N.

On *May* the 26th, I find the sun 6 d. of Π , and his right ascension is 64 d. and on the same day his oblique ascension is 34 d. now 34 d. from 64 d. there remains 30 d. his ascensional difference; which divide by 15 gives two hours, the time that he rises before, or sets after, 6.

This you may prove by *Prob. XV.* for you will find he rises at 4, and sets at 8, *May* the 26th.

But on *December* the 6th, his right ascension is 256 d. and his oblique ascension is 286 d. their difference is 30 d. which is 2 hours, that he rises after, or sets before, 6, which is 16 d. \int .

N. B. The right, exceeds the oblique ascension from v to xx , when the sun rises before 6; but the other half year that he rises after, or sets before, 6, the oblique exceeds the right ascension.

P R O B.

P R O B. XX.

The latitude and day of the month given, to tell the sun's amplitude; viz. his distance from the E. and W. points at his rising and setting; and the points of the compass he rises and sets upon.

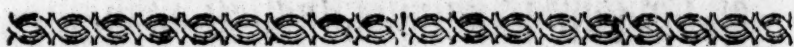
R U L E.

THE globe being rectified, bring the sun's place to the eastern verge of the *Horizon* (which shews his rising) then the degrees upon the innermost circle of the *Horizon*, counted from the true E. point to the place where the sun's place lies against on the *Horizon*, shews you the sun's amplitude.

EXAMPLE at L O N D O N.

Proceed according to the rule, you will find the sun's amplitude (*May* the 21st) at rising to be about 34° from the E. to the N. and at setting 34° from the W. to the N. and the point he rises upon is N. E. by E. and he sets N. W. by W.

W. But on *November* the 5th, he has about $25\frac{1}{2}$ d. amplitude from the E. to the S. and at setting $25\frac{1}{2}$ d. from the W. to the S. The point he rises upon is E. S. E. and the point he sets upon is W. S. W.



P R O B. XXI.

The latitude and day given, to tell the sun's Azimuth; viz. his distance from the E. and W. or from the N. and S. points at any time.

See Azimuth, Dial. VII. Sect. I. Article XI.

R U L E.

RECTify the globe in general, then turn the globe till the index points to the given hour; this being done, turn the quadrant, till it touches the sun's place for the given day; and then the quadrant will cut the *Horizon* in the *Azimuth* required

quired from the E. or W. points, or from the N. or S. points, for you may reckon from either, only then name it properly and accordingly.

Thus on *August* the 17th, at 9 in the morning, the sun will have about 30° *Azimuth* from the E. to the S. or, which is the same, 60° from the S. to the E. for 60° and 30° make 90° the whole quarter from E. to S.

N. B. Some authors call this 60° d. S. amplitude; but others call it 30° d. S. amplitude; that is, 30° d. from the E. to the S. as I said before.

This will appear yet plainer, if we would know the *Azimuth* of the sun the same day, at 11 in the morning; which is $68 \frac{1}{2}$ d. from the E. to the S. or $21 \frac{1}{2}$ d. from the S. to the E.

But on *May* the 21st, at 3 in the afternoon, he will have 25° *Azimuth* from the W. to the S. viz, 65° *Azimuth* from the S. to the W. And at $\frac{3}{4}$ past 5, his *Azimuth* is 10° from the W. to the N. or 80° from the N. to the W.

Tyro. Sir, I understand the demonstration quite well; but how am I to express, or name, the *Azimuth* in general?

H

Philo

Philo. By the words North and South, because it will always be either northward, or southward, reckoning from the E. and W. points, as the two southwards.

Thus as before, *August* the 17th, at 9 in the morning, the sun has 39° S. *Azimuth* (*viz.* from the E. point southward) but on *May* the 21st, at $\frac{1}{2}$ h. past 4 in the morning, he has 30° N. *Azimuth*; *viz.* 30° from the E. northward.



P R O B. XXII.

The latitude and Azimuth given on any day, to tell the hour, or time, of the day.

R U L E.

THIS is the reverse of the former problem; for the globe being rectified, turn the quadrant of altitude to the given degree of *Azimuth* (from the E. or W. point on the *Horizon*, and there

there hold, or steady, the quadrant with one hand, and with the other turn the globe, till the sun's place for the given day touches the figured edge of the quadrant, and the index will point to the hour, or time, required.

EXAMPLE for LONDON.

On *August* the 17th, I observed the sun's *Azimuth* to be 30° from the E. to the S. I would know the hour. Answer, 9 in the morning.

Again, On *May* the 21st, I find his *Azimuth* 10° from the W. to the N. what is the hour? Answer $\frac{1}{4}$ past 5 in the afternoon.



P R O B. XXIII.

The latitude, day, and hour given, to tell the sun's almicanter.

DEFINITION.

Almicanters are circles of altitude that run parallel to the *Horizon*,
H 2 whose

whose poles are the *Zenith* and *Nadir*; so that you may imagine as many circles of altitude, *viz.* almicanter, as you please.

R U L E.

The almicanter is found the same as the altitude of the sun at any time; therefore, I refer you back to *Prob. XIII.*



P R O B. XXIV.

The latitude and length of the day given, to tell what other day of the year will be of the same length.

R U L E.

HA V I N G found the sun's place for the given day, bring it to the meridian, and observe well its declination; then turn the globe till some other degree of the ecliptic comes under the same degree of declination under the meridian;

meridian; this being done, see what day of the month answers to the sun's place then under the meridian, for that is the day required; which you may easily prove by *Prob. XV.*

I would know what day is of the same length as *May* the 26th, and of the same length as *April* the 17th. Answer, *July* the 13th, and *August* the 20th.

Note, These last 8 *Problems*, as also *Prob. IX.* and *X.* are common to both globes; but are inserted here, because many persons have a *terrestrial*, that have not a *celestial globe.*

The following *Problems* more particularly concern, or belong to, the *terrestrial globe.*



P R O B. XXV.

The latitude and day given, to tell the beginning, ending, and (consequently) the length, or continuance, of twilight.

D E F I N I T I O N.

TWilight is that faint light which begins immediately after the sun sets in the evening, till he is 18° below the *Horizon*; and it begins in the morning, when the sun comes within 18° of the *Horizon* on the E. side, and ends when he rises. Therefore it is plain, that twilight is not only longer when days encrease in length; but it is also much stronger, as you will see presently by the work of the *Problem*.

Tyro. I have heard that this *Problem* is very difficult to what some are?

Philo. It is something longer in its operation, but very easy, if you mind the rule and the operation together.

O B S E R-

O B S E R V A T I O N.

As you were told that twilight begins and ends when the sun is 18° below the *Horizon*, and as the quadrant of altitude reaches no longer than the *Horizon*, therefore the rule is this.

R U L E.

The globe being rectified, &c. bring the opposite degree of the sun's place to the quadrant of altitude, so that it touches just 18° on the quadrant (then it is plain that the sun's real place will be depressed 18° below the *Horizon*) then look on the index, for that will point (if among the morning hours) to the beginning, or (if among the evening hours) ending of twilight.

Note 1. What I mean by the opposite place of the sun is this; it is that degree of the ecliptic opposite to, or 180° d. from the given place of the sun. Thus, suppose the sun was in φ , then I bring its opposite sign (*v.z.* \ominus) to 18° d. on the quadrant, so will φ be depressed 18° d. and the index will shew the hour.

Tyro. Sir, I now understand it very clearly.

Philo. Proceed then according to the rule, and you will find that on *March* the 21st, and *September* the 22d, twilight begins about 4 in morning, and ends about 8 at night.

The sun on these days you know rise and set at 6. Add, therefore, the length of morning and evening twilight to 12 hours (the length of the days then) and it gives 16 hours, this subtracted from 24 hours, leaves 8 hours, the length of the real, or dark, night.

So also on *April* the 24th, twilight begins about $\frac{1}{2}$ past 2, ends about $\frac{1}{2}$ past 9, which is in all 7 hours. But on *December* the 20th, it begins at 6, and ends at 6, which is in all but 3 h. 40 m.

Note 2. There is no real night at *London* (but twilight) from *May* the 22d, to *July* the 20th, the sun all that time being less than 18 d. below the *Horizon*.

P R O B.

P R O B. XXVI.

The hour given, where you are to tell what hour it is in any other part of the world. See Prob. VI.

R U L E.

BRING the given place to the meridian, and set the index at the given hour; then turn the globe till the other place, or places, come under the meridian, and the index will point to the real time in the place required.

E X A M P L E.

When it is 2 o'clock in the afternoon at *London*, I would know the time at *Jerusalem*, and at *Port Royal* in *Jamaica*?

Proceed according to the rule, and you will find, that when it is 2 in the afternoon at *London*, it is 25 minutes past 4 at *Jerusalem*; and but 52 minutes past 8 in the morning at *Port Royal*.

H 5

Another

Another METHOD.

I told you in *Problem VI.* that 15° on the *Equator* make 1 hour of time; therefore this *Problem* may be answered by common division, for having the difference of the longitude of any two places (taken from a map) divide it by 15, the quotient is the difference of hours; and, if any degrees remain, allow 4 m. for every degree, and so in proportion for the minutes or miles.

Thus I find by *Problem VI.* *Jerusalem* is $36^{\circ} 15'$ E. longitude of *London*; I divide, therefore, $36^{\circ} 15'$ by 15, and the quotient is 2 hours, and the remainder is 6, which is 6 times 4, or 24 m. and the odd 15 m. or miles, is 1 m. so that the difference is 2 hours 25 m. and as *Jerusalem* is E. of *London*, it has its hour before us, therefore it is 25 m. after 4 in the afternoon.

Again, *Port Royal* is $77^{\circ} 5'$ W. of *London*; this converted into time as before is 5 h. 8 m. that *Port Royal* has its time later than *London*; for when it is noon at *London*,

*don, it wants 8 m. of 7 in the morning
at Port Royal, &c. &c.*



P R O B. XXVII.

*The day of the month given, to tell those
inhabitants that will have the sun in
their Zenith (or over their heads) on
that day.*

O B S E R V A T I O N.

THIS cannot happen to any other
inhabitants, but in the *Torrid Zones*,
that is, to all such as have not **above** $23\frac{1}{2}$ d.
of latitude, either N. or S.

R U L E.

Bring the sun's place to the meridian,
and observe exactly his declination for
that day; then turn the globe any way,
and observe what places pass under that
degree of declination on the meridian;
for all such will have the sun right over
their

their heads some time or other on that day.

E X A M P L E.

I would know what inhabitants, or places, will have the sun in their *Zenith* on *May the 21st*.

Proceed as directed by the rule, you will find *St. Jago* in *Hispaniola*, *St. Jago* in *Cuba*, *Campechy*, and many other places that will pass under that degree of declination (*viz.* 20° N.) and will have the sun in their *Zenith* that day.

Also on *April the 16th*, the inhabitants of *Porto-Bello*, the *Oroonoko* islands, *Bay of Siam*, *Iste of Ceylon*, and the *Philippine* islands, will have the sun that day in, or near, their *Zenith*.



P R O B. XXVIII.

The day and hour given in any place, to tell those inhabitants, or that place, to which the sun is then vertical; viz. in the Zenith.

R U L E.

BRING the given place to the *Brazen Meridian*, and turn the index to the given hour; this done, turn the globe till the index points to the upper 12, or noon; then look under the degree of declination on the globe for that day, for that is the very spot, or place, to which the sun is then vertical.

E X A M P L E.

On *May* the 13th, at 8 m. past 5 in the afternoon, at *London*, I would know what place has the sun then in their *Zenith*. Answer, *Port Royal*.

N. B.

N. B. There are two days in which the sun is vertical to all the inhabitants in the *Torrid Zones*; which must be when the sun has the same declination, and in this *Problem* will be *July* the 27th; *viz.* the same declination as on *May* the 13th.

Thus also you will find when it is 33 m. past 6 in the morning at *London*, on *April* the 12th, and *August* the 28th, the inhabitants at *Candy* in the *Island of Ceylon*, will have the sun then in their *Zenith*.



P R O B. XXIX.

*To tell the distance from one place to another in degrees and minutes (viz. miles) in an arch of a great circle, * also their bearing, or situation, in respect of each other.*

R U L E.

* *Note*, 60 miles, or minutes, are reckoned a degree in general; but this is a vulgar error; for it is proved that every degree on the earth's surface in every great circle (such as the *Equator*, *Meridian*, &c.) is $69\frac{1}{2}$ miles; therefore, multiply the degrees by $69\frac{1}{2}$, you have the distance in *English* miles.

R U L E.

BRING one of the places to the meridian, and elevate the globe for the latitude of it, and fix the quadrant in the *Zenith*: then turn the globe till the quadrant touches the other place, and the degrees on the quadrant between place and place shews the distance; and the quadrant at the same time will cut the *Horizon* in the point of the compass, called the bearing, or situation, from the first place.

E X A M P L E.

I would know the distance from *London* to *Port Royal*, *Jerusalem*,* and *Moscow*, as also their situation in respect of *London*?

Proceed according to the rule, and you will find that from *London*

	Deg.		Miles.
To <i>Port Royal</i>	$68\frac{1}{2}$	} viz. nearly {	4760 $\frac{1}{4}$ W.
To <i>Jerusalem</i>	$33\frac{1}{4}$		2311 E. S. E.
To <i>Moscow</i>	23		1598 $\frac{1}{2}$ E. N. E.
P R O B.			

P R O B. XXX.

The latitude and day given, to tell what time the sun will be due E. or W.

Tyro. **T**HIS is easy I think; for as the sun is always due N. and S. at 12 at night, and at 12 at noon, I suppose he will be due E. and W. at 6 in the morning, and 6 in the evening.

Philo. I thought you would stumble upon this general error; but you will soon see your mistake.

R U L E.

Rectify the globe and quadrant as before directed: then turn the quadrant till it touches the E. or W. point of the *Horizon*; this done, turn the globe till the sun's place for the given day comes to the edge of the quadrant (holding the quadrant to the E. or W. point) so will the index point to the hour of his being due E. or W. on that day.

Proceed

Proceed thus, and you will find about 5 m. past 7 in the morning, on *May* the 21st at *London*, the sun will be due E. and about 5 m. before 5 in the evening due W. On *June* the 21st, he will be due E. about 22 m. past 7 in the morning, &c. but on *December* the 21st, he is due E. about 45 m. past 4 in the morning, and due W. about 35 m. past 7 in the evening.



P R O B. XXXI.

To tell how many degrees of the Equator (viz. how many miles) are contained in any parallel of latitude. Or, to find how many miles are contained in degree of longitude in any latitude.

R U L E.

1. **F**IX the quadrant in the parallel, and observe how far 10, 15, or any other number in that parallel will

will reach on the quadrant. Or thus, take off 10, 15, or any other number of degrees in the parallel given with a pair of good dividers, and apply that distance on the *Equator*, and observe how many degrees the same opening of the compasses cut on the *Equator*, for such is the proportion: therefore,

2. Bring the degrees that the dividers cut on the *Equator* into miles (which in this problem is customary to count 60 to a mile, because it in some measure relates to navigation) and divide that product by the number of degrees in the parallel, be it 10, 15, &c. and the quotient gives the answer.

E X A M P L E.

I would know how many miles (allowing 60 to a degree) are contained in the parallel of latitude 52?

I take 10 d. in the parallel of latitude 52, and apply that distance to the *Equator*, and find it cuts $6\frac{1}{6}$; viz. 6 d. 10 m. or, I take 15 on the parallel, and find it cuts $9\frac{1}{4}$, or 9 d. 15 m. Then I multiply

ply $6\frac{1}{2}$ by 60, and divide by 10, it gives 73; or I multiply $9\frac{1}{4}$ by 60, and divide by 15 (that I took off) in the parallel, and it also gives 37 miles, which are contained in 1 d. in parallel of latitude 52.

Proceed after the same manner by taking off 10, 15, &c. degrees in any parallel, and apply it to the *Equator*, you will have the miles in that parallel, according to this *Problem*; viz. 60 to a degree. Thus you find that in the

Miles.

Latitude	{	15	}	there con- tains about	{	53 to 1 degree.	
		30				51	56 m.
		45				42	44
		60				30	
		75				15	32
		90				00	

PROB.

P R O B. XXXII.

To find the Antæci to any place,

See *Antæcians*, Dialogue VI. Sect. IV.
Article I.

R U L E.

BRING *London* (or the given place) to the meridian, and count from the *Equator* on the meridian southward the same number of degrees of S. latitude, as *London* has N. (*viz.* $51^{\circ} 32'$) and close to the edge of the meridian make a dot, for that place is the *Antæci* to *London*.



P R O B. XXXIII.

To find the Periæci to London, or any other place.

See definition of *Periæcians*, Dial. VI.
Sect. IV. Article II.

R U L E.

BRING *London* to the meridian, and turn the globe till 180° of the *Equator*

Equator pass from *London* under the meridian; then under the same latitude as *London* (viz. under $51^{\circ} 32'$ N. at the edge of the *Brazen Meridian*) make a dot, for that is the place of the *Periceians* required.



P R O B. XXXIV.

To find the Antipodes to London, or any other place.

See definition of Antipodes, Dial. VI. Sect. IV. Article III.

R U L E I.

BRING *London* to the meridian, then the degree in the *Nadir* (viz. $38\frac{1}{2}$ d. from the S. pole) is the place of the *Antipodes* to *London*.

O R II.

Bring *London* to the meridian, and turn the globe till 180° pass thro' the meridian,

dian, then count $51^{\circ} 32'$ southward on the meridian, and under it make a dot, for that is the *Antipodes*.

Or rather thus :

Bring *London* to the meridian, then flip the globe in the notches of the *Horizon* ; viz. depress the pole, till *London* lies at the N. verge of the *Horizon*, just at the edge of the meridian ; then at the S. point of the *Horizon*, close to the meridian, make a dot, for that is the place of the *Antipodes* of *London*, which you will find to be in the *Great South Sea* $51^{\circ} 32'$ S. latitude, 180 longitude.

Thus also the *Antipodes* to *Cape Antonia* in *South America*, is the bay of *Nankin* in *China*. And the *Antipodes* to *Barbadoes*, is a little shoal in the streights of *Sapy*.

N. B. By bringing two places thus to the *Horizon*, which are *Antipodes*, you may in a great measure judge of the cause of eclipses ; for the places are diametrically opposite to each other, and you may imagine the sun to be one place, and the moon a. other.

P R O B.

P R O B. XXXV.

The longest day in any latitude given (supposing London $16\frac{1}{2}$ hours) to tell in what other latitude the longest day is 1, 2, 3, &c. hours longer than in the given place.

R U L E.

RECTify the globe for the given latitude (viz. London) and bring the solstitial colure (viz. ☊) to the meridian; then where the *Horizon* cuts the tropic of ☊, make a dot on the tropic at the verge of the *Horizon*: this done, turn the globe westward, till $7\frac{1}{2}$ d. of the *Equator* pass under the meridian, and then make a second dot on the tropick against the *Horizon* as before; then turn the globe back to its first position, (viz. to ☊) and then elevate the pole, till the 2d dot appears at the edge of the *Horizon*, and the *Horizon* at the same time will cut the meridian in the latitude required.

Proceed

Proceed as above, and you will find that in the latitude $56^{\circ} 20'$, the days are 1 hour longer than at *London*, which you may easily prove by *Prob. XVI.*

2. If you want to know the latitude where the day is 2 hours longer than at *London*, then proceed as before, only instead of causing $7\frac{1}{2}$ d. to pass under the meridian, you must now turn the globe till 15° pass under the meridian, and make then a 2d dot on the tropic.

3. If you want for 3 hours longer, make $22\frac{1}{2}$ d. pass through the meridian, and proceed as before; and thus for every hour, cause $7\frac{1}{2}$ d. more to pass under the meridian.

Note, If you want to know the latitude where the longest day is an hour shorter than at *London*, only turn the globe eastward instead of westward, till $7\frac{1}{2}$ d. pass thro' the meridian, and make a prick on the tropic, and depress the pole till this lies even with the *Horizon*, you will find the latitude about $45\frac{1}{2}$ d. Thus for 2 hours longer about 60° , for 4 hours about $64^{\circ} 20'$; but for 2 hours shorter

shorter the latitude is about $35 \frac{1}{2}$ d. This problem shews you the difference of climates.



P R O B. XXXVI.

Any time not exceeding 6 months given, to tell that latitude, or those places, where the sun will not set for all that time.

Note, That 28 days are here reckoned to the month. Bring the given time into days, and take the $\frac{1}{2}$ of the number of days; but remember to abate 1. If the $\frac{1}{2}$ exceeds 30, then count from *Cancer* on the ecliptic the same number of degrees as the $\frac{1}{2}$ amounted to, and where this reckoning ends make a dot on the ecliptic. *Lastly,* Bring this dot to the meridian, and as many degrees as are intercepted, or lie, between the dot and the pole itself, counted on the meridian, is the latitude required.

E X A M P L E.

I Demand the place, or latitude, where the sun does not set for the space of 4 months 16 days?

I

This

This is 128 days, the $\frac{1}{2}$ is 64° , abate 1° is 63° ; this I count from ☉ on the ecliptic, and make a dot, and bringing it to the meridian, I find there are nearly 80° between the dot and the pole; viz. the latitude is 80° , which is at *Smith's Inlet*, the upper part of *Greenland*.

So also in the latitude of 85° , he sets not for 5 months 2 weeks. And in the latitude of $86\frac{1}{2}^{\circ}$ d. for 5 months, 3 weeks, and 3 days; and in the latitude 90° , not for 6 months; viz. from *March* the 21st, to *September* the 22d.

Tyro. This appears, now, very plain to me, but I know the generality of persons believe it to be false, for want of consideration.

Philo. You see it is evident, for under the pole, in the latitude 90° , when the sun enters ♈, he begins to rise and set not with them till he enters ♏; viz. for 6 months.

Tyro. I see it, Sir, quite evident; but, pray, have they not also a great share of twilight? And are not the inhabitants at the contrary pole in darkness for a long time?

Philo.

Philo. Yes, and so are the inhabitants in the N. part, when the sun is in the tropic of \mathcal{V} . This is plainly demonstrated by the next *Problem*.



P R O B. XXXVII.

To tell in the latitude 90 (where the longest day is 6 months) how long it continues to be twilight after sun-set; and how long their night is after twilight ends, before it begins again.

R U L E.

YOU remember according to the last *Problem*, the sun sets with the inhabitants at the N. pole, and rises to those of the S. pole, on *September* the 22d: therefore twilight begins with them at the N. pole on *September* the 22d. Therefore,

R-U L E.

1. Elevate the pole to the *Zenith*, and turn the globe, till some degree of the sun's place in the ecliptic lies under 18° of the meridian, under the S. part of the *Horizon*, and you will find it 24° III; viz. *November* the 14th, the ending of twilight, that is, they have twilight from *September* the 22d, to *November* the 14th, and then they begin to have dark nights (save the advantage of the moon) till the 24th of *January*. For,

2. Turn the globe till some other point of the ecliptic comes under 18° as before, and you will find it about 5° of ♊ , which answers to the 24th of *January*; the beginning of twilight to the inhabitants at the N. pole, and then on *March* the 21st, he rises with them.

Thus it appears, that the length of their day (from sun-rising to sun-setting) is from *March* the 21st, to *September* the 21st. The length, or continuance, of twilight, is from *September* the 21st, to *November* the 14th, and from *January* the

the 24th, to *March* the 21st, in all about 110 days, and their real night is from *November* the 14th, to *January* the 24th; viz. about 71 days.

Note, The same holds good to the southern inhabitants at the S. pole, for he rises with them when he enters \square , and sets with them when he comes to γ , &c.

Tyro. I perceive it plainly, Sir; and thank you for this plain demonstration.

Philo. Now, *Tyro*, I shall shew you the use of the *celestial globe*; and after that set you some *Problems*, with the practical use of both.

Here follows some *Problems* on the *celestial globe*.



P R O B. XXXVIII.

The day of the month given, to find the sun's place in the ecliptic.

See *Problem VII*.

P R O B. XXXIX.

This is the reverse of the last, and done
the same as *Prob. VIII.*



P R O B. XL.

*To find, or tell, the declination of the sun
on any day of the year.*

The same as *Problem X.*



P R O B. XLI.

To find the sun's right ascension.

See *Prob. XVII.*



P R O B. XLII.

*To tell the sun's oblique ascension and de-
scension in any latitude, and on any day.*

The same as *Prob. XVIII.*

P R O B.

P R O B. XLIII.

*The latitude and day given, to find the
sun's ascensional difference.*

The same as *Prob. XIX.*



P R O B. XLIV.

*The latitude and day of the month given,
to tell the sun's amplitude; viz, his dis-
tance from the E. and W. points at
rising and setting.*

The same as *Prob. XX.*



P R O B. XLV.

*The latitude and day given, to tell the sun's
Azimuth.*

The same as *Prob. XXI.*

P R O B. XLVI.

*The latitude and Azimuth given, to tell
the day, supposing it were lost.*

See the rule, *Prob. XXII.*



P R O B. XLVII.

*The latitude, day, and hour given, to tell
to sun's almicanter.*

See the rule, *Prob. XXIII.*



P R O B. XLVIII.

To find the right ascension of any star.

R U L E.

B R I N G the center of the star to the
meridian, and the degree of the equi-
noctial,

noctial, cut by the *Meridian*, is the right ascension required.

Thus you will find the right ascension of *Aldebaran* in *Taurus*, to be about 65° , *Arcturus* in *Bootes*, about $210^{\circ} 45'$, *Regel* in *Orion*, about $75^{\circ} 30'$, and *Sirius*, or the *Dog-Star*, about 98° d. &c. &c.



P R O B. XLIX.

The latitude given, to tell the oblique ascension and descension of any star.

R U L E.

RECTIFY the globe, and bring the star down to the eastern verge of the *Horizon*, and the degree of the equinoctial, that is then cut by the *Horizon*, is the *oblique* ascension required. Turn the star to the western side, and the degree of the equinoctial, cut by the *Horizon*, is the star's *oblique* descension.

Proceed thus, and you will find the *oblique* ascension of *Regel* to be about $86^{\circ} 30'$, of *Marhal* in *Pegasus*, about 325, and of *Aldebaran*, or *Bull's Eye*, about $43^{\circ} 30'$. Turn each of these to the western side, you will find their *oblique* descension 54° , 360° nearly, and 87 degrees.

Note. There is this difference between the right and *oblique* ascension and descension of the sun and stars. For the sun's *oblique* ascension, &c. differ every day in the same latitude, but the stars *oblique* ascension is every day the same.



P R O B. L.

To tell the declination of the stars.

R U L E.

AS for the sun's place, so also here, bring the given star to the *Brazen Meridian*, and observe what degree of the *Meridian* lies right over the center of the star, for that is the declination either
N. or

N. or S. according to which side of the equinoctial it lies of.

Thus you will find the declination of *Aldebaran* to be about $16^{\circ} 45'$ N. The upper pointer to the pole (in *Ursa Major*) about $63 \frac{1}{2}$ d. and the lower one nearly $58 \frac{1}{2}$ d. but *Regel* in *Orion* I find about $8 \frac{3}{4}$ d. S. and *Cor Scorpio* about 26 d. S. declination, &c. &c.

From this *Problem* and the XLVIIIth ariseth



P R O B. LI.

The right ascension and declination of any star given, to find the same at once.

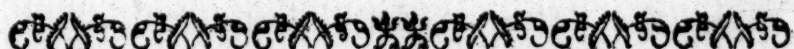
BRING the given degree of right ascension on the equator to the *Brazen Meridian*, then look under the degree of declination on the *Meridian*, and you will find the star at the *Meridian*, under the given degree of declination.

Thus,

180 *The use of the GLOBES.*

Thus, suppose I wanted to find *Aldebaran*, whose right ascension is 65° and his declination $16^\circ 45'$ N. I first bring 65° of the equinoctial to the *Meridian*; and looking under $16^\circ 45'$ N. declination on the *Meridian*, I find *Aldebaran*

So also *Sirius* has 98° right ascension, and $16^\circ 50'$ S. declination; therefore I bring 98° d. of the equinoctial to the *Meridian*, and looking under $16^\circ 30'$ S. declination on the *Meridian*, I find *Sirius* just at the *Meridian*. The same for any other star.



P R O B. LII.

To tell the rising and setting of the stars, and the point of the compass any star rises or sets upon in any latitude, and on any day of the year.

R U L E.

RECTIFY the globe, and bring the sun's place to the *Meridian*; then
turn

turn the globe till the given star comes to the eastern verge of the *Horizon*, and the index will point to the time of rising, and the *Horizon* will shew the point it rises upon: turn it to the West, and the index will point to the time of setting, and the *Horizon* will shew you the point it sets upon.

Proceed thus, and you will find that *Aldebaran*, on *November* the 5th, at *London*, rises a little past 6 in the evening, and sets about 9 in the morning. The point he rises upon is E. N. E. and the point he sets upon is W. N. W. But *Rigel* in *Orion*, the same night, rises a little before 9 at night, and sets about $\frac{1}{2}$ past 7 in the morning. The points of rising are W. by S. and setting E. by S.

Note, The stars rise and set every day on the same point of the compass, though at contrary hours.

P R O B. LIV.

To tell the time; viz. how many hours any star continues above the Horizon, from its rising to its setting, in any latitude.

R U L E.

Rectify the globe, then bring the star to the eastern verge, and note the time of rising, then turn the globe to the western side; and the number of hours that passed through the dial-plate tells you the continuance of that star above the *Horizon*.

Thus, I find *Aldebaran* at *London* continues up from the time of his rising on any day (but for example take *December* the 25th) about 15 hours; and *Regel* about $10\frac{1}{2}$ hours.

At *Stockholm* *Aldebaran* continues up above 16 hours; but at *Port-Royal* he continues up but about $12\frac{3}{4}$ hours.

P R O B.

P R O B. LIV.

To tell the distance of one star from another in degrees and minutes, in the arch of a great circle.

TO this Problem are three variations ;
1. If the stars lie under the same Meridian, bring them to the *Brazen Meridian*, and the degrees intercepted between them, counted on the *Meridian*, is the distance required.

Thus, I find, the two pointers in the *Great Bear* to be about $5\frac{1}{2}$ d. distant from each other ; and *Eridef* and the *Dolphin's Eye* about $29\frac{1}{2}$ d. distant.

2. If they lie under the same declination, bring the first (at pleasure) to the *Brazen Meridian*, and note the degrees cut by the *Equator* ; then bring the other to the *Meridian*, and note how many degrees difference has passed through the *Meridian*, for that is their distance required.

Thus, I find, the difference between *Affengue* and *Caput Medusæ* to be about

122 $\frac{1}{2}$ d. for *Affengue* ($38\frac{1}{2}$ declination) being brought to the *Meridian*, cuts $277^{\circ} 30'$ viz. $82^{\circ} 30'$ from γ westward; and *Caput Medusæ* cuts $40'$ of the *Equator* eastward; their distance, therefore, is $122^{\circ} 30'$.

3. If neither of the stars lie under the same degree of the *Meridian*, or declination, then bring either of them to the *Meridian*, and elevate the pole to the same height as the star has declination (that is, the same as you elevate the terrestrial globe to the latitude of a place) for then the star will be in the zenith: therefore, fix the quadrant to the zenith, over the center of the given star, and extend it to the other star, and the degrees on the quadrant is the distance required in a true arch of a great circle.

Note. Though the distance of the stars from each other are thus determined in degrees, yet you are not to suppose their Distance is so many degrees to be converted into *English* miles; but it only means, that they appear so far distant under such an angle,

Thus, I find the distance between *Capella* and *Cor Hydra* to be about 79° d. and between *Aldebaran* and *Sirius* about $46^{\circ} 30'$ &c.

4. If

4. If the stars be such a distance from each other, that the quadrant will not reach them, then bring either of them to the *Horizon*, and elevate, or depress the pole, till the other lies also at the verge of the *Horizon*, and the degrees counted upon the *Horizon*, between star and star, is their distance in degrees.

Thus, between *Aldebaran* and *Cor Scorpio* you will find about 170 degrees.



P R O B. LV.

To tell what stars will be on, or near the Meridian, at noon and at midnight.

First, for those at noon.

BRING the sun's place to the *Meridian* for the given day, and all those stars that are then under the *Meridian*, are such as are full S. at noon.

2. Turn the globe till the index points to 12 at night (*viz.* the lower 12) and all those

those stars that are then under the *Meridian* are the stars required.

Thus, I find, on *May* the 27th, *Aldebaran* is on the *Meridian* at noon, and *Cor Hydra* will be on the *Meridian August* the 7th at noon; but on *February* the 3d, *Cor Hydra* will be full S. about night. For only turn *Cor Hydra* under the *Meridian*, and the index will point to the lower 12; and the *Meridian* itself will cut the ecliptic in 15 d. of ♊; viz. *February* the 3d.



P R O B. LVI.

The latitude, day of the month, and height of any star given, to tell the time or hour of the night.

R U L E.

RECTIFY the globe for the latitude, &c. &c. then fix the quadrant in the zenith, and move the globe and the quadrant together, till the star cuts the qua-

quadrant in the given heighth; and the index will point to the hour.

EXAMPLE.

On *January* the 21st (at *London*) in the evening I observed *Aldebaran* E. S. E. to be about 40 d. high; I demand the time of this observation? *Ans.* A little past 5 in the evening. Again, on *December* the 25th, in the evening, I observed *Sirius* to be about 15 d. high, and at the same time *Regel* to be about $28\frac{1}{2}$ d. high; I demand the hour? *Ans.* About 10 at night; and *Aldebaran* is under the *Meridian* at the same time.



PROB. LVII.

To tell what stars never rise, and those that never set at London.

RULE.

- I. O NLY observe what stars have above $38\frac{1}{2}$ d. N. declination; for

for all such never set at *London*, but are always above the *Horizon*.

2. Observe also those stars that have above $38 \frac{1}{2}$ d. S. declination, for those never rise, but are always under the *Horizon* at *London*.

Thus, the pointers in the *Great Bear*, *Arides* in *Cygnus*, and many others, never set.

Also, *Canopus* in *Argo*, *Navis* and *Pes Centaurus*, and many others, never rise at *London*.

OBSERVATION.

1. From what you have been taught, *Tyro*, it is easy to conceive, that to the inhabitants under the North pole no South star can ever be seen, nor can the inhabitants at the South pole ever see one of the stars in the other hemisphere. But,

2. The inhabitants under the *Equator* have a pleasant sight of all the stars from pole to pole; for they rise and set with them at right angles; therefore no star can continue above 12 hours above this *Horizon*.

Tyro. Sir, you have highly obliged me, and I see now very plainly the different aspect of the heavens in different places.

P R O B.

P R O B. LVIII.

To know at any time of the year (in the latitude of London) where to find any star, or tell the name of any star when required.

R U L E.

RECTIFY the globe for the day, and turn it till the index points to the given hour; then by a quadrant take the heighth of the required star; or, for want of which (in a common way of guessing) observe what part of the heavens it is in; viz. whether E. N. E. S. W. or the like, as also its heighth as near as you can guess: this being done, set the globe in due order for the day and hour, and you will find the same star on the globe; and, by applying the quadrant, you will find the exact point of the compass, and the real heighth the star then has, which, tho' not perhaps near to what you guessed it at, yet, if it be any noted star, you may assure yourself you are right, as there is
no

no other star of note near it about that height, and upon the same point.

E X A M P L E.

Walking on *December* 25, at 8 at night, I observed a bright star (as near as I can guess) on the S. E. point, and about 48 d. high; I would know what star it is? *Ans. Aldebaran.* I rectify the globe, and turn the index to the hour, and then turn the quadrant to the given point of the compass, and looking about 48 d. high on the quadrant, I find *Aldebaran* to be the nearest bright star by the quadrant on that point and height, therefore, I conclude it is *Aldebaran*.

Also at $\frac{1}{4}$ past 10, the same night, I see two very bright stars, one on, or near the *Meridian*, about 30° high, and the other near the S. E. point, and about 35° high. I demand their names. *Ans. Regel and Procyon in Canicula.*

P R O B. LIX.

To tell the latitude and longitude of the stars.

FIRST, observe, whether the given star be on the N. or S. side of the ecliptic; for if it be on the N. side, elevate the N. pole $66\frac{1}{2}$ d. and turn the globe till ☉ and ♄ lie in the N. and S. points of the *Horizon*; viz. the ecliptic will be parallel, or even to the *Horizon*, and fix the quadrant in the *Zenith*: then keeping the globe steady, turn the quadrant till the edge of it touches the center of the star, and that degree on the quadrant (viz. the altitude of the star in the latitude $66\frac{1}{2}$ d.) is the latitude required, and the degree of the ecliptic, cut by the quadrant, reckoned from *Aries* (or rather reckoned among the signs, as it happens) is the longitude required.

Thus you will find *Arcturus* in *Bootes* to be about $30\frac{1}{2}$ d. N. latitude, and 203° longitude from ♄, or rather 23 d. of ♄. Also, *Alcair* is about $29\frac{1}{2}$ d. of N. latitude, and 28 d. of longitude in ♄.

2. For

2. For any South Star.

Elevate the S. pole $66\frac{1}{2}$ d. and fix the quadrant in the zenith, and apply it to the star, as before directed, you have the latitude and longitude required. Thus you will find *Pes Centaurus* to have about $42\frac{1}{2}$ d. of S. latitude, and 236 d. longitude from Υ , or rather 26 d. in III ; and thus for any other star. See *Table III. Dial. VII.*



P R O B. LX.

The latitude and day of the month given (suppose December 25, at nine at night at London) to set the globe so as to represent the face of the heavens at that time, and shew your acquaintance the name and position of the most eminent fixed stars.

R U L E.

RECTIFY the globe for the latitude, and bring the sun's place to the *Meridian.*

rid'an, and the index to 12. Then turn the globe to the given hour; *viz.* 5 minutes past 9 at night, and there fix it, so will every star on the globe (if you set the the globe N. and S.) correspond with, or point to, the same star in the Heavens.

Thus (at *London*) I find *Capella* E. by S. about 75 d. high, *Castor* and *Pollux*, one about 40, and the other about 45 d. high; near the E. point. *Procyon* below them, to the left hand, 23 d. high E. S. E. *Sirius* yet lower, to the left, S. E. about 10 d. high; *Betelgeuze* higher, on the same point, and about 38 d. high; *Regel*, more southward, about 26 d. high; *Aldebaran*, on the same point, much higher; *viz.* about 53 d. the *Seven Stars*, or *Pleiades*, S. nearly about 62 d. high; *Mencar*, S. by W. 40 d. high; *Aridef* N. W. about 26 d. high, &c. &c. &c.

P R O B. LXI.

To tell the time of the acronical rising and setting of any star.

D E F I N I T I O N.

1. **T**HE *acronical* rising of a star is when the star rises just at the sun-set.
2. A star is said to set *acronically*, when it sets with the sun.

R U L E.

Bring the sun's place for the given day, to the western side of the *Horizon*, and all those stars that are on, or near, the eastern side of the *Horizon*, rise *acronically*; and those on the western verge of the *Horizon* set *acronically*.

Thus I find on *December* the 6th, that *Aldebaran* rises *acronically*, but it sets *acronically* on *May* the 21st. Also *Sirius* rises *acronically* on *February* the 4th, and sets *acronically* on *May* the 14th.

P R O B.

P R O B. LXII.

To tell the cosmical rising and setting of the stars in any latitude.

D E F I N I T I O N.

1. **A** Star is said to rise *cosmically*, when it rises with the sun.
2. A star is said to set *cosmically*, when it sets at sun-rising.

R U L E.

Rectify the globe, &c. and bring the sun's place to the eastern side of the *Horizon* for the given day; then all those stars cut by the eastern verge of the *Horizon*, rise *cosmically*. The globe still remaining in the same position, look at the western verge, or edge, of the *Horizon*, and all those stars cut by it, or that are very near it, set on that day *cosmically*.

Thus I find that *Arcturus*, and 2 small stars in *Hercules's* thigh, rise *cosmically*, September the 25th. Also 2 stars in

K 2

Erida-

Eridanus, Affengue in Lyra, &c. &c. set *cosmically*. *Markal in Pegasus*, is but just below the *Horizon*, therefore may be said to set nearly *cosmical*, as it will within a day or two.

For the *cosmical* setting.

Turn the globe till the star comes to the western side of the *Horizon*, and observe the degrees of the ecliptic, then cut by the eastern side of the *Horizon*, for that will answer to the day of the *cosmical* setting.

Thus *Arcturus* sets *cosmically*, June the 22d. Also *Aldebaran* sets *cosmically*, December the 20th.



P R O B. LXIII.

To tell the heliacal rising, or setting, of the stars.

D E F I N I T I O N.

1. **H**ELIACAL rising, is when a star once in the sun's beams gets out

out of them, so as to be seen at the eastern verge of the *Horizon*, just before sun-rising.

2. *Heliacal* setting, is when a star once out of the sun's beams gets into them, so as to be seen setting on the western side of the *Horizon*, just after sun-set.

Note 1. This *heliacal* rising and setting of the stars is different, according to their different magnitudes. For

Note 2. Stars of the first magnitude are seen at rising and setting, when the sun is but 12° below the *Horizon*. Stars of the 2d magnitude are not perfectly seen, till the sun is 13° below the *Horizon*. Those of the 3d degree, when he is 14° . Those of the 4th degree of magnitude, when he is 15° below the *Horizon*. Those of the 5th degree, when he is 16° . Those of the 6th degree, when he is 17° ; and the *nebulous*, or small ones, not till he is 18° below the *Horizon*; viz. about the beginning and ending of twilight.

R U L E.

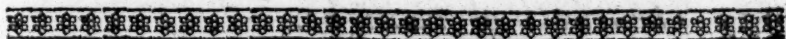
To find the *beliacal* rising, or setting, the rule is, rectify the globe, and bring the given star to the eastern verge of the *Horizon*; then fix the globe, and turn the quadrant to the western side, till 12° of the quadrant touches the ecliptic; this done, note the degree of the ecliptic, that is, cut by 12° of the quadrant on the western side (for then will the real place of the sun be depressed 12° on the eastern side) for that degree sought in the calender gives the *beliacal* rising. The same is to be observed with the quadrant on the eastern side for the *beliacal* setting. Thus you will find *Aldebaran* rises *beliacally*, *July* the 4th, sets *beliacally*, *May* the 5th.

And *Sirius* the *Dog Star* rises *beliacally*, about *August* the 26th *.

And

* N. B. The poets, and others formerly, used to reckon their *Dies Caniculares*, or *Dog Days*, from the *beliacal* rising of *Sirius*; but they did not agree when they ended. Some reckoned them to continue 30, or 40, and others 50 days, However, in this they agreed, that the weather

And now, *Tyro*, I will leave you one question for practice at your leisure, in order to exercise you in the foregoing *Problems*.



P R O B. LXIV.

The latitude and day given (suppose at London, November the 5th) to tell,

1. *THE rising and setting of the sun, and the point he rises and sets upon.*
2. *His meridian altitude.*
3. *His altitude at any hour, supposing 10 in the morning.*
4. *His right and oblique ascension.*
5. *His ascensional difference.*

K 4

6. *His*

weather at any time was very sultry and faint for 5, or 6, weeks after the rising of *Sirius*. But (as it was then, so now) it is a ridiculous whim; for *Sirius* does not now rise *beliacally* till near *September*, though our almanack-makers for what reason I know not) continue the beginning of *Dog Days*, *July* the 30th. But, however, it is plain that *Sirius* can no ways be charged with bringing this sultry weather; because 3 or 4 thousand years hence he will not rise *beliacally* till *November*, and then, perhaps, will be charged with bringing as much cold by the same rule.

6. *His amplitude at rising.*
7. *His Azimuth at 10 in the morning.*
8. *His almicanter the same time.*
9. *The time is due E.*
10. *The length of day and night.*
11. *The length of twilight.*
12. *The length of the real night.*
13. *The inhabitants to whom he will be vertical that day.*
14. *The very place to which he will be vertical at 10 o'clock at night at London. Also,*
15. *To tell what time Aldebaran, or any star, will rise and set that night.*
16. *To tell also what time any star will be due E. or W. (suppose Aldebaran) what is its amplitude at rising and setting, its Azimuth at 8 at night, and the time of being full S. Also,*
17. *To tell what point of the compass the pointers will then be on, and what time they will be on the meridian above, and under the pole star.*

Tyro. You may depend, Sir, upon my trying to work this *Problem* the first opportunity.

Philo.

Philo. Very well; since you delight in these things, I will not leave you yet, but will shew you some *Problems* relating to navigation and spiritual triangles, &c. Here follows,



S E C T. II.

Containing some more useful Problems in navigation.

P R O B. I.

The sun's declination and hour, when he is due E. given, to find the latitude, viz. the elevation of the pole.

R U L E.

RECTIFY the globe to the same latitude as the given number of degrees of declination, and fix the quadrant in the *Zenith*; then convert the hours that the sun is due E. before, or after, 6 o'clock, into degrees, and count the same num-

K 5

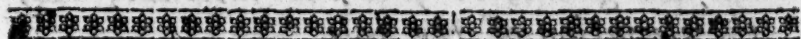
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ber of degrees on the *Horizon* from the E. point southwards, and bring the quadrant to that degree of the *Horizon*, so shall the degree on the quadrant that is cut by the *Equator* be the complement of latitude, which taken from 90° , gives the latitude itself, or height of the pole.

E X A M P L E.

Sailing *May* the 21st, I made an observation that the sun was due E. about 7 m. past 7 in the morning, and his declination $20'$ N. I demand what latitude I was in?

Proceed by the rule, you will find the latitude to be $51 \frac{1}{2}$ d. nearly.



P R O B. II.

Having the sun's Azimuth at 6 o'clock, and declination, to find the latitude.

R U L E.

AS many degrees as are contained in the *Azimuth* given, so much elevate

vate the pole, and fix the quadrant in the *Zenith*, and bring Υ to the meridian: this done, count on the quadrant upwards, the complement of the sun's declination to 90, and bring that degree to the *Equator*, then the degree of the *Horizon*, cut by the quadrant, shall be the complement of latitude, counted from the S. point, or else from the N. as it may happen, and the remainder to 90 is the latitude required; or otherwise, the degrees counted from the other 2 cardinal points, either E. or W. as it may happen, will give the latitude.

E X A M P L E.

I find the sun's *Azimuth*, at 6 o'clock, to be 12 d. 15 m. and his declination 20 d. 10 m. what is the latitude? Work according to the rule, you will have the answer $38\frac{1}{2}$ d. complement, that is $51\frac{1}{2}$ d. latitude required.

P R O B.

P R O B. III.

The sun's amplitude and ascensional difference given, to find the elevation of the pole and sun's declination.

R U L E.

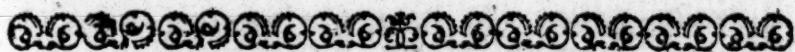
RAISE, or elevate, the pole so many degrees as is the ascensional difference, and fix the quadrant in the *Zenith*, and bring Υ to the meridian, then count on the quadrant upwards the complement of altitude, and move the quadrant, till the same number on the quadrant cuts the *Equator*; and the quadrant will cut the *Horizon* in the degree of the pole's elevation, and the *Equator* in the degree of declination.

E X A M P L E.

I made an observation, that the sun's ascensional difference was 27 d. 10 m. and his amplitude 33 d. 20 m. I demand the latitude and declination?

Proceed

Proceed according to the rule, and you will find the latitude $51^{\circ} 30'$, and the declination $23^{\circ} 10'$.



P R O B. IV.

The sun's altitude E. and his declination given, to prove the elevation of the pole.

R U L E.

ELEVATE the pole to the complement of the sun's altitude at E. and fix the quadrant in the *Zenith*, and bring Υ to the *Meridian*, then number on the quadrant of altitude the degree of declination, and bringing the same to the *Equator*, observe what degree the quadrant cuts the *Equator* in; for its complement to 90 d. is the height of the pole.

E X A M P L E.

The sun's declination is $20^{\circ} 10'$, N. his altitude at E. (at *London*) is nearly 26 d.
I would

I would know whether the supposed latitude ($51 \frac{1}{2}$) agrees herewith in operation?

Here I subtract 26 from 90 d. and there remains 64 d. complement of altitude, and I elevate the pole accordingly, &c. Then I bring Υ to the *Meridian*, and cause $20^{\circ} 10'$ on the quadrant to cut the *Equator*, and find it nearly $38 \frac{1}{2}$ d. the complement of latitude required; which, subtracted from 90, gives $51 \frac{1}{2}$ d. the real latitude of the place.



P R O B. V.

*The sun's declination and amplitude given,
to find the height of the pole.*

R U L E.

ELEVATE the pole to the complement of amplitude, and fix the quadrant in the *Zenith*, and bring Υ to the *Meridian*, then count the sun's declination

tion on the quadrant, and bring that degree to the *Equator*; and the degree of the *Equator*, cut by the quadrant, is the latitude required.

E X A M P L E.

Suppose the sun's amplitude $33^{\circ} 20'$, his declination $20^{\circ} 10'$, what's the latitude?

Proceed according to the rule, you will find it about $51^{\circ} 30'$.

Tyro. I heartily thank you, Sir.

Philo. There are many other questions relating to navigation, which may be deduced from these, and performed on the globes; which you will find treated of by and by.



S E C T. III.

Contains some practical Problems, relating to spherical triangles, applied in some measure to navigation, dialling, &c. by which the learner will see more of the nature of the doctrine of the sphere, than be possibly can by way of plane.

Note 1. That every triangle has 3 sides and 3 angles.

2. The *Perpendicular* (called also *Cathetus*) shall be here represented by, or placed on, the *Brazen Meridian* itself.

3. The base shall be placed in general upon the *Equator*.

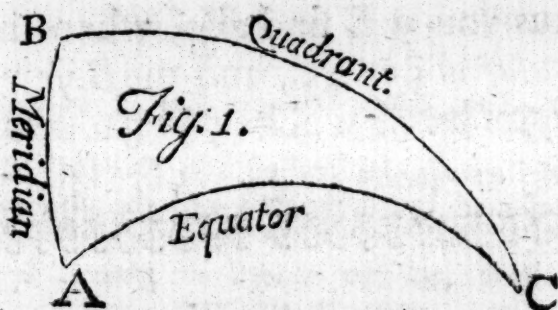
4. The *Hypothenuse* (or diagonal line) is represented by the quadrant fixed to the *Zenith*, and turned to the extremities of the *Perpendicular* and *Base*, which will form a compleat right angled triangle.

5. A right angled triangle is such as has one of the angles right, or that contains 90 d. An acute angle is less than 90 d. and an obtuse angle is more than 90 d. as you will see by *Prob. V.*

P R O B.

P R O B. I.

In the right angled spherical triangle ABC,
let the perpendicular AB be $42^{\circ} 30'$,
the base AC $60^{\circ} 15'$. I demand the
hypothenuſe BC ?



BRING γ to the *Brazen Meridian*,
and there faſten, the globe ; then
count from *Aries* $42^{\circ} 30'$ on the *Brazen*
Meridian, which is the perpendicular,
and at $42^{\circ} 30'$ fix the quadrant of al-
titude. Then count from *Aries* on the
Equator $60^{\circ} 15'$, which ſhall repreſent
the *Base* ; and note well the degree on the
Equator, or elſe make a ſmall dot. This
done, turn the quadrant till the figured
edge

pothenuse BC) just touches $60^{\circ} 15'$ on the *Equator*; for then will the *Meridian* from *Aries* to the nut of the quadrant tell you the perpendicular AB; viz. $42^{\circ} 30'$. See the figure.



P R O B I I I .

The perpendicular AB $42^{\circ} 30'$ Hypothenuse BC $60^{\circ} 15'$ given, to find the base AC.

R U L E .

COUNT from *Aries* on the *Meridian* $42^{\circ} 30'$ the Perpendicular AB, and there fix the quadrant; then turn the quadrant till $68^{\circ} 15'$, on the quadrant from the *Zenith*, touches the *Equator*, and the degrees on the *Equator* intercepted between the point *Aries*, and the quadrant, shews you the base AC; viz. $60^{\circ} 15'$. See the figure.

Tyro. I understand the operations quite well.

Philos.

Philo. I am glad of it; and this pleases me much to see you can apply things so well: for as you observe the *Horizon* cuts the meridian at right angles, as well as the *Equator*; therefore, by counting the *Perpendicular* from the *Horizon* on the meridian, the quadrant will still be the *Hypothenuse*, and will cut the *Horizon* at the contents, or degree, of the *Base*, as it did the *Equator* before.

From hence arises the following observations.

OBSERVATION I.

The N. and S. part of the *Brazen Meridian* being 180° distant, it is plain that the quadrant of altitude fixed in the *Zenith* will (however extended) make 2 angles equal to 180° , or half the circle. For instance, if I lay the quadrant from the *Zenith* to the E. or W. points, I then have 2 right angles, each equal to 90° , viz. 180° ; and, if I move the quadrant from these points, suppose 30° to the N. or the S. I still have 2 angles made by the quadrant, the *Meridian* and *Hori-*
zon

zon equal to 180° : viz. one of them equal to 120° , and the other equal to 60° .

OBSERVATION II.

From hence then it very plainly appears, that you may (by a little consideration) know the measure of any side, or the angle forming any 2 sides of a triangle; viz. whether it be an *acute* angle (viz. less than 90°) or an *obtuse* angle (viz. more than 90° ;) for all the 3 angles together are always equal to 2 right angles; viz. 180° , as in the last observation.

Tyro. I am still more highly obliged to you, Sir, for this clear demonstration.

Philo. I shall then leave it wholly to your consideration and practice, as it is so natural in itself, and proceed to an useful application of *Prob. I.*



PROB.

P R O B. IV.

A ship sails from the N. latitude 55 d. 45 m. in a direct course, till she comes to the Equator, and her difference of longitude is 76 d. 30 m. E. from the place where she departed: I demand the rhumb in navigation she is then upon, and the distance from the place she sailed from, allowing 60 miles to a degree, and her distance in an arch of a great circle, viz. $69\frac{1}{2}$ miles to a degree?

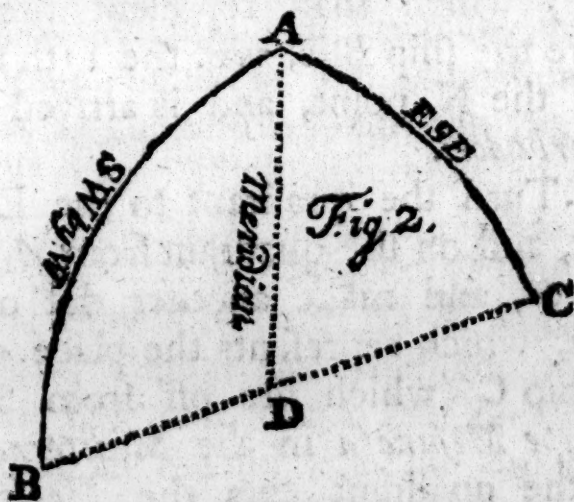
Note, See the operation at the end of *Problem I.* which is $79\frac{1}{2}$ d nearly; allowing then 60 to a degree, it is 4770 miles; but at $69\frac{1}{2}$ to a degree, is 5525 miles $\frac{1}{4}$ quarter.



P R O B.

P R O B. V.

Two ships, B and C, are in the latitude $51\frac{1}{2}^{\circ}$ N. and in 18° W. from London, from which place they set sail; B goes S. W. by W. $51^{\circ} 30'$, and C sails E. S. E. $39^{\circ} 3'$. I demand,



1. The rhumb (from the N.) each ship sailed upon,
2. The angle they make at setting out.
3. Their difference of longitude from the place they set out at.

4. Their

4. Their distance and situation from each other. And
5. The places they arrive at.

1. **T**HE globe rectified, and Υ brought to the meridian, turn the quadrant from *A* the Zenith, till it cuts the S. W. by W. point, and at $51^{\circ} 30'$ from *A* upon the quadrant, make a dot on the globe, which shall represent the place where the ship *B* is, viz. the 11th rhumb from the N. point, and is arrived nearly at *Barbadoes*.

2. Turn the quadrant to the E. S. E. point, and on the quadrant from *A*, count $30^{\circ} 30'$, and make another dot on the globe, which represents the place of the 2d ship *C* (which lies off from *Tripoly* by *Cape Mesurata* in the *Mediterranean*) and the quadrant cuts the *Horizon* in the 10th rhumb from the N. point.

3. Observe what angle the quadrant cuts the *Horzion* in, counted from the S. point, or meridian, *AD* itself, and you will find that *B A D* is $56^{\circ} 15'$, and *D A C* (viz. *D C*) is $63^{\circ} 30'$, the angle

gle the 2d ship makes with the meridian at A.

5. Add these 2 angles together, shews the whole angle that *A* makes with the *Horizon*; viz. *B C D* $123^{\circ} 45'$.

5. Bring the place each ship is in to the meridian separately, it will shew you the difference of their meridian from the first setting out; viz. their difference of longitude: that *B* will be found to have made 41 d. 15 m. of W. longitude, and *C* 34 d. 15 m. of E. longitude from the place at first. Their difference of longitude is 75 d. 30 d.

Lastly, For their distance, bring either of the ships (suppose *B*) to the meridian, and elevate the pole accordingly, and fix the quadrant in the *Zenith*, and extend it to the 2d ship, or dot *C*, on the globe, and you will find it about 70 d. 14 m. N. E. by E. of *B*. the distance required; which multiplied by 60, gives 4245 miles, and by $69\frac{1}{2}$, gives 4917 miles nearly.

Tyro. I could not have thought the use of that little appendant, the quadrant, had been so extensive; for, I

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perceive plainly now, that when the quadrant is fixed in the *Zenith*, it always makes 2 angles, both of which must of course be 180 d. Thus, if I turn it right to the E. point, I have 2 angles, called right angles, each of which is 90 d. *viz.* 180 d. If I turn it any where else at pleasure, suppose on the E. N. E. point, I then have 2 angles, *viz.* the *Zenith* from the N. point itself, to the E. N. E. point, which is 67 d. 30 m. called an *acute angle*, or less than 90 d. and the other angle from the S point, to E. N. E. is 112 d. 30 m. which is 22 d. 30 m. more than 90 d. or a *right angle*, and is called an *obtuse angle*.

Philo. I am glad to see you can turn what I have shewn you into so good an application. I shall, therefore, shew you how to make a common dial, from whence you will naturally see the nature of the sphere more plainly, and by the intersection of the different circles, will be able to raise many curious and useful *Problems*.

PROB.

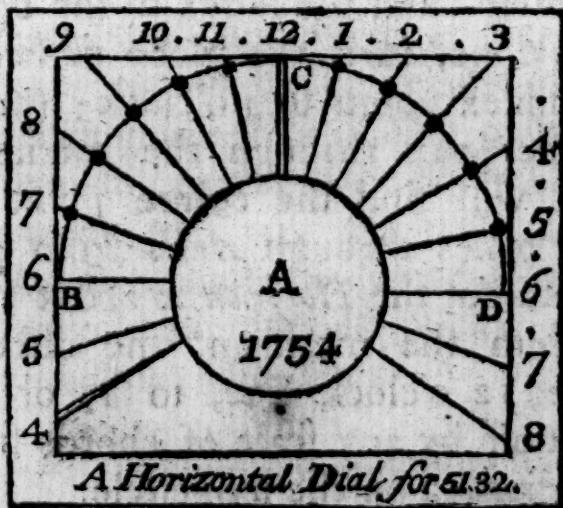
P R O B. VI.

To make an horizontal dial (viz. a dial to be set upon a post, or pedestal) in any latitude ; but suppose for London.

E X A M P L E.

LET it be required to make an horizontal dial for the latitude of *London*.

First, Take a piece of brass, or a thick smooth painted piece of board, the size



you intend your dial for ; and describe a semicircle at pleasure from the center *A*.

L 2

Secondly,

220 *The use of the GLOBES*

Secondly, Divide this semicircle into 2 equal parts by the line *A 12*.

Thirdly, Draw the lines by the extremity of the circle to contain the hour lines; and thus is your plane, or dial, ready to have the hours drawn from the center.

Now to find the distance from the meridian, or 12 o'clock line, in degrees or minutes.

R U L E I. is,

Bring the vernal colure (*viz.* Υ) to the meridian, and the index to the upper 12; this done, turn the globe *westward*, till the index points to 1 o'clock; (or till 15 degrees pass through the meridian) and you will find the colure (*viz.* the line that passes through *Aries* from pole to pole) to cut the *Horizon* in about 11 d. 50 m. from the meridian, the distance from the 12 o'clock line, to 1, or 11, which set off by any scale of chords from the meridian 12 on the semicircle.

Secondly, Turn the globe till the index points to 2, and the colure will cut the *Horizon* in 24 d. 15 m. the distance
from

from 12 to 2 or 10 : turn the globe till the index points to 3, the colure will cut the *Horizon* from the *Meridian* in about 38° , $10'$ the distance from the *Meridian* to 3 or 9 : turn it till the index points to 4, and the colure will cut the *Horizon* in 53° $36'$ in the distance from 12 to 4 or 8. Turn it till the index points to 5, and the colure will cut the *Horizon* in better than 71° , the distance from the *Meridian*, or 12 o'clock line, to 5 or to 7. The 6 o'clock line will be 90° , or fall in the line *CD*; viz. the colure will cut the *Horizon* at 90° , or in the *E.* point.


Secondly, Take off these degrees and minutes from any sector or scale of chords; and setting one foot of the compasses in *C*, set off on the circle from *C* towards *B* and *D*, 11° $50'$, 24° $15'$, &c. &c.

Thirdly, From the center *A* draw lines through these dots or pricks, and you have the true hour lines.

Note 1, The halves and quarters are found the same, by turning the globe till the index points to $\frac{1}{2}$ past 12; $\frac{1}{2}$ past 1, &c. and observing in how many degrees the colure cuts the *Horizon* from the *Meridian*.

Note 2, After you have drawn the hours from 12 to 6 in the morning, and 6 in the evening, you may easily get the the hours at 5 and 4 in the morning, by laying a ruler from the hours of 5 and 4 in the afternoon, and drawing lines through the center. The same on the other side of the plane, drawn from 7 and 8 in the morning, will be 7 and 8 at night.

Note 3, The style or gnomon of this dial makes an angle with the 12 o'clock hour line of 51 d. 32 m. and must be put in at the center *A*, and stand right up over the 12 o'clock line, or meridian of the plane.

 *Note,* Always remember to make an allowance for the thickness of the style or gnomon on the plane, by drawing two lines by the side of the *Meridian* line, as wide as the style is thick.



PROB.

P R O B. VII.

To make a direct S. dial in the latitude of London.

There are two ways.

FIRST, let the globe remain for the latitude of *London* as before, and fix the quadrant in the *Zenith*, and turn it to the E. point, and there fix it (or to the W.) then turn the globe to 11 o'clock or to 1, and the coloure will cut the quadrant in 90° 30'.

Turn it to 10 or 2, the colure will cut the quadrant in 19 d. 32 m. the distance from the *Meridian*.

Turn it to 9 or 3, it cuts the quadrant in 32 d. 10 m.

Turn it to 8 and 4, it cuts it in 48 d. 5 m.

Turn it to 7 and 5, it cuts it in 67 d.

Or,

2. Elevate the pole to the complement of *London's* latitude to 90 (*viz.* for $38\frac{1}{2}$ and

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51 $\frac{1}{2}$ make 90) then turn the globe till the index points to 11 or 1, and the colure will cut the *Horizon* in 9 d. 30 m. turn it to 10 or 2, the colure will cut the *Horizon* in 19 d. 32 m. &c. as before.

Tyro. Sir, I am extremely obliged to you, but if it were not too much trouble, I would desire you to give me one example how to make a verticle dial that declines from the S. either east or westwards; for you know that it is a chance indeed that a wall should exactly face the south.

Philo. I am ready to do every thing *Tyro* that lies within the compass of time, room, and ability. We will suppose then it were required as follows; *viz.*



P R O B. VIII.

To make an erect, or vertical dial, declining from the North towards the East or West.

E X A M P L E.

Let it be a dial declining from the N. eastward 60 d.

R U L E.

1. **R**ECTIFY the globe, quadrant, colure, and index, as before.
2. Bring the quadrant of altitude to cut the *Horizon* in the degree of declination; viz. 60 d. from the N. point, either eastward or westward, which represents a plane, declining that number of degrees.
3. Hold the quadrant fast at 60 d. and turn the globe eastward, till the index points to all the forenoon hours, and the colure will cut the quadrant on the number of degrees each hour is distant from the *Meridian*; and lines drawn through

each of these from the center, are the hours required.

Thus to find the forenoon hours,

I turn the globe till the index points to 11, 10, 9, &c. or till 15 d. of the *Equator* pass through the *Meridian*, and I find the colure cuts the quadrant (from the *Zenith*) as follows,

		d.	m.
11	o'clock	9	30
10	————	18	15
9	————	26	12
8	————	35	5
7	————	45	10
6	————	57	20
5	————	76	00

The forenoon hours required, which will be on the W. or left-hand side of the 12 o'clock line, because the plane declines eastward, and consequently you have more hours in the forenoon than in the afternoon on this plane.

2. *To*

2. To find the afternoon hours.

I now turn the quadrant to the opposite point of the *Horizon*; viz. I cause it to touch 60 d. of the *Horizon* from the S. towards the W. and bring the index and colure back to the *Meridian*.

Then turning the globe westward till the index points to 1, 2, 3 and 4, or till 15 d. pass through the *Meridian*, and the colure will cut the quadrant (counted from the *Zenith*) as follows,

For 1	o'clock	12	45
2	————	29	45
3	————	52	45
4	————	80	15

These are the distances of the afternoon hours, from the 12 o'clock hour or *Meridian*. Here you see the colure goes off the quadrant; therefore the sun goes off this plane about 4.

3. To

3. To find the distance of the substyle or place of the gnomon from the 12 o'clock line; as also the height of the stile, do thus:

Bring the colure to the *Horzion* in the plane's declination, counted from the S. towards the E. viz. bring the colure to 60 d. in the *Horizon*, counted from the S. eastward; and then turn the quadrant till *that* touches the same number of degrees (viz. 60 d.) from the N. eastward: so shall the quadrant and colure cut each other at right angles; and the number of degrees counted on the quadrant from the colure to the *Zenith* are the degrees of the substyle's distance, viz. $21^{\circ} 40'$; and the degrees from the pole to where the quadrant cuts the colure, counted on the colure, is the height of the stile, viz. $32^{\circ} 45'$.

Lastly, Measure or take off $21^{\circ} 40'$ from any scale of chords, and setting one foot at the 12 o'clock line, turn the other westward, or to the left-hand, and make a dot or prick, for right over this dot must the substyle or gnomon stand.

And

And thus by a little consideration may any sort of *declining, inclining, or reclining* dials be easily made by the globe. For a direct S. dial at *London* will be an *Horizontal* dial to the inhabitants of $38^{\circ} 28'$ S. latitude; viz. 90 d. distance from our *Zenith*.

So an *erect* plane under the pole is an *Horizontal* under the *Equator*. An *erect vertical* at 80 d. N. latitude, will be a *Horizontal* in 10 d. S. latitude, &c. &c.

Tyro. Sir, I heartily thank you; for this gives me a greater notion of the position of places and planes than I had before. But pray may not some *Problems* relating to the moon be performed by the globes?

Philo. Yes; the very same as the sun, when once you know her place in the ecliptic; but this you must do very often, because of her place according to her mean motion; but this so very quick and variable that the operation will not stand long, or hold good, but for that day only: but by getting her true place, you may tell her rising, setting, and southing, the hour of the night, the time of high water, &c. &c. I will

I will give you a small notion of it, and leave the rest for your curiosity. Divide the equinoctial into 30 parts (*viz.* at every 12th degree) by red strokes or figures, marking it from *Aries* at every 12th degree, 1, 2, 3, 4, &c. this represents the 30 days of her age.

Now to find her place. Elevate the N. pole in the *Zenith*, and bring the equinoctial colure against the day of the month in the *Horizon*, so shall the moon's age (wrote in red figures) on the equinoctial, point to the degree she is in at that time.

Tyro. I am extremely obliged to you, Sir, for all these favours; but, as necessity obliges me to go, I beg you would excuse me, and receive my hearty thanks.

Philo. My dear pupil, I wish you well, and would recommend to you the practice of these things at a suitable opportunity, rather than spending your time in trifles and idleness.

Tyro. Sir, I thank you for your good advice, and am your humble servant.

Philo. Farewel.

P O S T-



POSTSCRIPT.

Here follows an account of the Patent Globes, which are mounted by the Patentee, Mr. JOHN NEALE, at his house in Leadenhall-street, London.

THE terrestrial globe is mounted with the *Horizon* fixed vertical, and the globe placed to move therein upon its own axis, thereby to represent its diurnal motion; besides which, it also moves upon the axis of the ecliptic, to demonstrate all the mutations of the seasons, from its annual motion. At a distance from the globe is a ball, to represent the sun, which remains fixed; and from the N. pole some wheel-work is placed, to convey a motion to the moon, which moves round

232 P O S T S C R I P T.

round the globe; and between it and the sun, in $29\frac{1}{2}$ days, from one conjunction to another, but round the earth itself in less than $27\frac{1}{2}$ days; through the center of the sun runs a piece of steel, called a pointer, to take in and out at pleasure, which represents a direct ray from the sun, and (by means of some wheel-work at the S. pole) shews all those countries to which the sun, at any particular time, is vertical, and if observed six months successively, or while the sun is passing from one equinoctial point to the other, or from tropic to tropic, will afford a pretty appearance. Suppose, for instance, the sun to be in the northern tropic, or that of *Cancer*, by that pointer will be shewn, as the globe is turned about, that a vertical ray represents a spiral line round the earth, from the tropic of *Cancer* to that of *Capricorn*, and then back again from *Capricorn* to *Cancer*, each line every day at noon falling at the distance of about seven minutes from that of the preceding day; which being so clearly demonstrated by this method of mounting, that any person may have a very just idea of the

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the true cause of all the variations of the seasons, even from this particular; for from hence a youth will be naturally led to examine why this phænomenon happens; when, upon a diligent observation, he will soon perceive that it springs from the N. pole, receding more and more from the sun, by the earth's advancing in its annual circuit. Thus, let us now suppose it to be *June* the 21st N. S. the pointer then falls directly on the tropic of *Cancer*; when it will be observed, that all the countries on the N. side of the *Equator* have their days at the greatest length, and that this length encreases with their distance from the *Equator*. Hence also the youth will perceive the natural cause of its being all day and no night, to all the inhabitants within the *Artic* circle, whilst the reverse of this happens to those who people the *Antarctic*; and, as he turns the globe about, to observe his pointer approaching the *Equator*, he will be no less agreeably entertained by viewing as many degrees within the *Artic* circle roll below the *Horizon*, as his pointer has receded from the
 afore-

aforementioned tropic, till it arrives at the equinoctial line, when it will appear self-evident why the days and nights are then equal all the world over, by noting the S. pole, which before never appeared above the *Horizon*, now shews itself even with it, while, at the same time, the northern one, which was much elevated above it, is now upon a level therewith, and that the *Horizon* and circle, which is the boundary of light and darkness, and which before cut the parallels of latitude or declination unequally, now bisects the same, and causes an equal distribution of day and night throughout the whole *Terrene*. If from henceforward the youth continues the rotation of the globe, he will observe, that as many degrees as the same pointer advances on the S. of the *Equator*, just so many degrees will the N. pole descend below the *Horizon*, till it arrives at the tropic of *Capricorn*, when the extremity only of the *Artic* circle will appear even, or upon a level therewith; and, consequently, all those countries between that circle and the pole, will then begin to lose sight of the sun's body;
and,

and, whilst the inhabitants of the southern pole enjoy an uninterrupted day, those in the northern one are sunk in obscurity and twilight.

I have said before, that on the terrestrial globe of this new improvement, the moon moves between the earth and sun; I shall now add, that at the distance of a quadrant of a circle from the moon, is placed another circle, which being fixt on the center of the moon's motion, always moves round with her, thereby shewing throughout her course, all those countries in the northern hemisphere to which she is at any particular time rising, those where she is then setting, and those to whom she is then due S. as also, the exact difference of time between the rising and setting of the sun and moon, all which will be further enlarged on, when I come to shew the method of solving the *Problems* relating thereto. After I have spoken a little relating to the celestial globe, which is mounted not quite so different from the common globes, as that I have been speaking of.

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The *Horizon* in this is as usual, and the globe moveable to the latitude of any country, only instead of those upright pillars to support the *Horizon* as common, here semi-circles are fixed on the pedestal, and from the pole of the *Equator* a motion is conveyed to the pole of the ecliptic, where two arms, or indexes, are placed, on which the artificial sun and moon are posited (much after the nature of that excellent contrivance communicated to the *Royal Society*, in the year 1747, by the ingenious Mr. *Ferguson*) these, as the globe is turned about, keep their exact motions over the same, similar to, and in like manner as those two luminaries do in the heavens; so that once being set right by an ephemeris, they will remain so, and thereby shew the rising and setting of these luminaries, with the length of the day and night; together with the true cause of all the vicissitudes of the seasons; and though they have a motion seemingly from E. to W. yet do they really move from W. to E. the moon in very little more than $29\frac{1}{2}$ days, and the sun in a year. For instance, suppose

P O S T S C R I P T. 237

suppose it now to be the 10th of *March*, the sun entering *Aries*, and the moon in conjunction with him, if I turn about the globe with the key, I shall observe when the moon has got round the point *Aries*, from whence she first set out, which will be in little more than 27 days (which is called her periodical month;) that, notwithstanding, she has made an entire revolution round the earth, yet will she not be got in conjunction with the sun; because, that during the time she is performing this her periodical revolution, as a secondary round the earth, that primary, and of course the moon itself, its sattelite, has advanced almost a whole sign, or thirty degrees *in consequentia*, or according to the order of the signs in the *Zodiac*; so that, *that* point in her orbit, in which she was, when in conjunction with the sun at her first departure, will be now so far to the westward, as to take her up two days, five hours, one minute, three seconds, before she comes in conjunction with him again, or has completely exhibited all her phases. Hence the globe must be turned more than twice about

about again, before the moon can overtake him, which at once affords a very clear idea of the difference between the periodical and synodical month.

Here also may be observed, that the sun's coming above the *Horizon* is very different with respect of time, he rises much sooner, and sets much later; and, therefore, the days of course are longer, and nights shorter, in the northern hemisphere; and that with regard to place, he likewise rises and sets in a different part of the *Horizon*, which difference is called the difference of his amplitude, now rising N. E. and setting N. W. whereas before he rose due E. and set due W. and, if the globe be set to any latitude, within the arctic circle, the sun and moon will then move round, without descending below the *Horizon*, at certain times, from whence you will naturally discern the reasons why these variations thus happen.

I cannot here omit taking notice, how beautifully this method of exhibiting the heavenly appearances represent those luminaries we have been speaking of in
their

their apparent motions to the inhabitants of the polar circles. For instance, if the globe be rectified to the latitude of any country within the artie circle, by only turning the globe about with the winch, you will observe, how many days the sun shines upon them without setting, and how many days he is totally absent; as in the former case, the sun will continue above the *Horizon* for several revolutions of the globe, so in the latter, he will not make his appearance above it for some considerable time. From whence it will be naturally demonstrated, how impossible it is for the inhabitants of that place to have any sight of a new moon, during the sun's continuance below the *Horizon*, any more than they will be able to discern a full moon, while the sun is above their *Horizon*.

Again, From the stem on which the sun is fixed, two little balls (representing *Mercury* and *Venus*) are so contrived, as to take on and off at pleasure: and as their stems are made with joints, they may be placed at any number of degrees distant from the sun, answering to their true place

240 P O S T S C R I P T.

place in the heavens at any given time; by which their appearing alternately as morning and evening stars, and every *phænomena* that happens to them may be very readily exhibited: but then these can't (with convenience) be placed upon the globes less than 12 inches diameter, they being too small to admit of them.

And thus by the mounting, or adding, such appendant to the common globes, the most ignorant person may see at once (as it were) the beauty, and harmony, and order of the sun, and the inferior planets belonging to, and revolving round him as their common center, according to the present system of astronomy.

N. B. Globes thus mounted, are at present but of two sizes, *viz.* those of 3 and 12 inches diameter, which are to be had of the *Patentee*, at his house in *Leadenhall-street, London*, as aforesaid.

The price of the 12 inch globes, mounted in a beautiful manner with the aforesaid apparatus, is 16 guineas, and the price of those 3 inches diameter, is 6 guineas.

F I N I S.

